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Incentive or Production Basis of Wage Payment

I. Constructive Preparation Necessary—Effect of Working Conditions on Mental Attitude—Elements of Scientific Management—Determining the Standard Production Time

By HENRY H. FARQUHAR

THE manufacturer is today confronted by an unrelenting taskmaster—Price. In order to keep our heads above water during this period of readjustment it is necessary that materials, men, and money be utilized to the utmost. In a search for practical measures to meet this situation through cheaper production, many manufacturers are making the error of trying to shift an undue portion of the burden to the shoulders of the workmen. In their endeavor to increase profits, they are installing a great variety of methods of paying operatives based on what is produced, without appreciating the fact that production payment is a means that can be safely used to induce the workmen to help meet the situation *only* when the management does its part.

Incentive payment is, I believe, unquestionably a good thing provided it is not a one-sided affair. The particular system of payment, however, is comparatively unimportant if it rests on an adequate foundation for the general administration of the productive activities of the workmen which it is supposed to stimulate. In a poorly managed plant even the best scheme of payment may do more harm than good. A manager of my acquaintance became enthusiastic some time ago about the savings secured in his neighbor's plant after a new method of payment was put into effect. He forthwith proceeded to put the same method into his own factory. He awoke some six months later to find that some of his men has been earning such exceptional wages that the other workmen in the plant had been led into voting for a strike in order that they also might receive equally high wages. Having heard nothing of such labor troubles in the other plant he decided something must be wrong. Upon investigation he found that his friend had been laying the foundation for incentive payment during the preceding two years.

Points for Consideration

It would have been helpful if, before installing a stimulative wage plan, this manufacturer had considered the many prerequisites to incentive payment. Fairness as well as good business would have dictated that he consider first of all his own and his executives' part in the *administration of work*—the management's responsibility in planning and scheduling what is to be done; second, the various questions covering the character of the *standards of accomplishment;* third, the type and amount of the *reward for standard accomplishment;* fourth, the principles to be observed in *assigning and recording production;* fifth, the choosing of the *period over which performance is to be determined;* sixth, the question of *sharing the reward by the supervisory force;* and finally the *method of pay* itself. It would, of course, be claiming too much to say that all of the provisions set down in succeeding discussions are imperative in every case for arriving at the answer to all problems of method of payment; they are more in the nature of guides, differing in importance with different circumstances, which experience has proved should be departed from only after a very careful analysis of local conditions.

The Administration of Work

The incentive method of wage payment is essentially an appeal to the workman to put forth his best efforts toward high production. In essence, it is saying that the management proposes to pay him not simply according to time put in, but primarily for amount of work turned out. To get maximum results from this appeal, it follows first that facilities in the shop must be such that he *may* (if he desires) produce a big day's work, and second that he be in a frame of mind where he will *want* to produce. Bringing both of these conditions to pass is distinctly a management duty, and until the management has seen to it that its part is fully played, the incentive appeal will meet only half-hearted and temporary response and can at best be only partially effective.

An incentive payment system to operate successfully, must be based on the following rules: (1) *The management must assume responsibility for high production, high wages, and low cost, commensurate with that expected of the workman.*

Any other foundation for an incentive payment method is but "passing the buck" to the workmen and is quickly recognized as such. The attempt to secure the "individual initiative" of the workman sometimes made through such methods is entirely sound in principle and constitutes a valuable feature of these plans if given its proper place and weight. The initiative of the workman, however, can function only through the initiative of the management, as the operative can have little direct effect upon the preliminary steps that must be taken in order to make his work effective and on the day-to-day measures necessary to keep it so.

Six Major Administrative Functions

Thus, the volume of work put through any given shop depends directly upon the care which is given to *standardization, planning, preparation, scheduling, production,* and *inspection*—six major functions of the administration of work in process. Of these, five—or all but the actual production—from their very nature fall almost solely upon the management, and the importance of these five far outweighs the importance

of the one element—incentive pay—contributing to the one remaining function of production. Only a brief indication of the scope of each of these functions and of the management's duty as regards them, can be given.

Standardization: This term is used in its broadest sense to mean determining the best method of doing work and adhering strictly to that standard until a better one is developed. Specifically it means that materials and the material routine be scientifically studied and systematically governed[1]; that machines be overhauled, with particular reference to the work they are called upon to perform, as regards power, drive, speeds, gear ratios, tools and appliances, and all other factors affecting the amount and accuracy of work put through them; that processes, both hand and machine, be constructively studied and brought to the most efficient stage; that methods of delivery and removal of materials and product, and in general of the administration of all work of the establishment, be similarly scrutinized and standardized, and finally that all such standards be systematically maintained up to the goal set. The advantages of such standardization and maintenance are too obvious and too well known to require discussion, but it must be recalled that such work is entirely outside the province of the workman although his productivity on the job depends largely on how effectively it is carried out by the management.

Planning: For each piece of work entering the shop, modern requirements demand that before processing starts, a determination be made of what is to be done, of how it is to be done, of where it is to be done, of when it is to be done, and finally, of who is to do it. The first three of these constitute planning proper, and between these three and the actual doing of the work falls the preparation of materials, tools, and instructions, and the determination of times and personnel or scheduling.

Planning, therefore takes care of the provision of bills of material and drawings; of the indication of the character and quality of all materials required, and of the operations to be performed on each part; of the machines of other work-places where each operation is to be performed; and of the manner in which, in the assembling operations, all of these parts are to be brought together and assembled into the finished product. The degree to which such plans may be blocked out in advance varies in different industries and under different conditions, but such planning is probably the most characteristic feature of modern as against old-style management. No competent engineer would think of starting the erection of a bridge without first going through these preliminary steps with utmost care, yet many plants today do this planning on the run, as work progresses.

Preparation: Preparation must then be made so that the plans as made may be properly carried out. This function therefore, consists in supplying the right quantity of the right materials when needed, in providing the requisite number of standardized machines, the proper tools and appliances, detailed instructions for each operation or process, the necessary men, and all of the pieces of paper needed in transmitting orders and recording progress and cost of performance. In other words, it sees that everything which is needed to put the work through when the time comes, is on hand ready for use.

Scheduling: Scheduling of work then takes care of the time element through designating the starting and finishing times for each process on each part, considering proper sequence in relation to assembly and delivery dates and the balance between machines and departments of the plant as a whole. Depending on the value of the product, on the degree of standardization, on the adeqaucy of maintenance, on the accuracy of time studies, and on the mechanism for correlating and adjusting frequently inconsistent time requirements, the accuracy of scheduling may vary all the way from that of the Ford or the Franklin companies to that of the jobbing shop. As a general rule, however, it may be said that the more diverse the product the greater need there is of detailed scheduling, and the greater benefits there are to be derived from it.

Production: Production consists in transforming raw into finished materials and products.

Inspection: Inspection determines whether a given material or part conforms to specifications and drawings. This is an adaptation of the functions of management as developed at the Winchester Repeating Arms Co., New Haven, Conn.

Such, briefly, is the foundation for the administration of work in process upon which any incentive method for the payment of wages must be reared. It has been the general experience of those who have had most to do with developing high production management in various industries, that of the increases in production resulting from modern methods upwards of 75 per cent of the pick-up comes through just such thorough standardization, detailed planning, careful preparation, and accurate scheduling. while ordinarily only 25 per cent or less is secured through additional effort on the part of the individual operatives themselves. It follows that "soldiering" is not so common as is sometimes intimated, and that to go after the 25 per cent without first getting the 75 per cent is not only the lazy way but also the dangerous way, in that even the 25 per cent may be withheld by the workmen due to lack of confidence thus created.

The Standards of Accomplishment

We have now outlined the major duties of the management in the operation of a production system whereby the work of the shop may be systematically administered, and it will be noted that at no point do these measures intimately touch or concern the workman except in the broad sense that any measures of standardization and of routing indirectly affect, either for good or for evil, the work and sentiments of the man at the machine. The upkeep of the shop and the methods of getting work to and away from the workman are to him primarily the management's affair and only secondarily his in so far as they affect his state of mind as regards his work, for under any specific set of conditions a workman might feel with perfect justification that he was delivering "a fair day's work" in time and effort although he might know that were those conditions improved he could produce much more in the same time with the same amount of effort.

When we get to the next step, however, in paving the way for possible production payment, that of establishing standards of accomplishment by which the worker's performance may be translated into resulting earnings or otherwise used to measure his efficiency or stimulate

[1]See articles by the writer in the *American Machinist*, page 1338 of Vol. 52 and on pages 101 and 151 of Vol. 53.

his ambition, we are dealing with a question which touches him intimately (through the pay envelope or through his sense of workmanship) with every job that comes to him. There are consequently numerous points as regards standards of accomplishment which experience has proved must be carefully considered.

(2) *The Standard should be on a basis which does not vary with changing conditions; it should be adapted to the type of work and to the character of the workmen, and it must be such that the workmen readily understand it.*

There is one and only one yardstick for measuring efficiency of performance of the individual workman which is absolutely unvarying under changing conditions; namely, time. Total volume of production may change; costs—either direct labor or prime or total, and no matter whether "standard" or actual—are constantly fluctuating with every change in process or rate of wages; overhead ratios ordinarily indicate nothing at all; dividends are unsafe and earnings are unstable guides—all of these may and usually do bob up and down regardless of whether the workman continues to perform at 100 per cent. In addition to this, and of more importance, the worker does not understand such bases and ordinarily has no means of checking his performance against them if he did. On the other hand, *time*—the time in which a man performs whatever work is given him—is the one constant and unvarying measure in the great majority of cases for determining efficiency of operating, and one which every worker understands and constantly uses as a measure of his work.

Although of course time is directly convertible into earnings so that the latter basis may be used with equal accuracy, it is nevertheless true that individual or group earnings vary with every change in piece or hourly rates of pay, and that therefore constant revision is necessary if a standard based on earnings is to mean the same thing throughout all the ups and downs of the market.

Time-Standard Is Constant

A standard expressed in time, however, requires revision under only one condition: a change in method. The volume of work, due to conditions beyond the control of the operative, may drop to one-half normal; wage rates, costs, overhead, and profits similarly have only a distant relation to the work of the individual at the machine; but a lot of fifty pieces in eight hours means exactly what it says day in and day out regardless of how many of such lots may be available for the man to process or what the material in them may have cost the purchasing agent, and so on. I have had several interesting sessions with managers who had some one of these other bases in mind, convincing them of the permanency and simplicity of time as a measure for the performance of workmen under widely varying conditions.[2] There are of course some processes where time is of decidedly secondary importance, such as maintaining uniform pressure or temperature, and in such cases the standard would be based on the maintenance of such factors within predetermined allowable ranges.

Necessity of Motion-Study

The next rule logically follows if the standard is to be serviceable and if trouble is to be avoided: (3) *The standard must be accurately determined and properly used.*

This involves careful time (including motion) study to analyze each operation into its elements, to study those elements separately and to discard wasteful and to substitute economical methods, and finally to determine once and for all for each job, what a fair time allowance for its completion should be. The details of these methods cannot be discussed, but if the results of time study are to be permanent and worth the considerable cost of obtaining them, the work should be undertaken only under the supervision of men experienced in this specialized and somewhat explosive field.

Granted that the results of time study are adequate, however, (and the determination of their adequacy at any particular stage calls for lots of (un) common sense and perspective), it is equally important that they be put to a proper use, for I have seen some very shortsighted practices installed under the scientific guise of "time study." I refer particularly to the form of payment with which they are used, where the studies themselves may be correct but where the method is wrongly chosen. This point is brought out at various places in succeeding discussions.

(4) *The standard should be high but within the reach of any one who is fitted for the class of work to which it applies.*

The fact must not be lost sight of that the possible value of a performance standard may be lost through making it either too high or too low. Both are equally shortsighted, for in the one case the operative will become discouraged in his attempt to reach it, and in the other case he will lose interest when it fails to call forth his best efforts Although it is usually desirable, for reasons which need not be discussed here, to use the best men available for the purpose of securing information on which the standard is set, the standard itself should be based neither on the work of the poorest man nor on that of the pace setter. Just where the line should be drawn must be determined in each case; where many workmen are engaged on the same operation the standard may be correspondingly high and may reasonably be such that even the average worker can reach it only after the period of training and instruction without which the maximum production is impossible.

Another Point Necessary to Success

To check the fairness of the standard and to secure the confidence and co-operation of the workers whom it is to affect, another point should be observed: (5) *The standard should be agreed to by those to whom it is to be applied, with provision for readjustments when mutually desirable.*

The foreman particularly should approve all standards before they are announced to the men, and ordinarily the men should be given an opportunity to express themselves as to the justice of what is being asked of them. If the proposed standard is not so unreasonably high that it no longer appeals to their ambition and sense of fair play, nothing is to be lost by putting it up to them; on the other hand any valid objections they may have had much better be brought out before than after it is announced. This policy of consulting the men does not mean of course that scientifically set standards of work must be compromised for every objection which they may bring forward, but the refusal to compromise must be backed up with a demonstration of the reasonableness of what is asked.

[2]Although a consideration of profit sharing does not strictly fall within the scope of this paper it may be remarked parenthetically that one of the chief shortcomings of this plan for stimulating workmen on direct production is indicated in the preceding discussion, in that profits are not sufficiently closely related to and dependent on the performance of the individual at his daily work.

In this connection a definite provision for changes in standards with changes in method should be made. A standard when once fixed and agreed upon must not be changed upon the whim either of the workmen or of the management (in the latter case usually the foreman), but only after an investigation as thorough as that from which the original standard was derived. A change in methods is ordinarily the only excuse for an upward revision of standards, and even then the previous earnings should always be allowed, for standards should not be announced until the management is ready to stand back of them; in other words, if a mistake is made in favor of the workman, the management should stand the loss, while mistakes unfavorable to the workman should be corrected by a downward revision. In any event a joint machinery for the consideration of contemplated changes should be set up at the time of investigation.

The measures discussed in the foregoing topics form the basis of all worth-while management whether or not one agrees that incentive pay is a good thing. As indicated previously, in the average shop much more is to be gained through the management's assuming these burdens than can be obtained through asking the individual workman to assume the burden of doing the relatively insignificant amount which he, unaided, can accomplish in increasing production. There is much evidence to show that in many cases with proper standardization, planning, scheduling, and so on, plus the setting and following up of tasks or standards of performance, no additional spur is needed in order to induce men to do what may be reasonably expected of them, and in any event the bonus or other system of incentive pay usually should be and ordinarily is the last thing to tackle in developing scientific management in the factory. The very fact that the management is doing what every workman has a right to expect it to do, calls forth a response from him, and had such standards been generally in effect during the past few years it is safe to say that production would not have decreased in so many cases as wages increased, and that the cost of living would not have mounted to its recent height.

Non-Productive Costs—Discussion

By S. Owen Livingston

There was an interesting editorial in the *American Machinist* a short time ago, provoking thoughts on the subject of "Non-productive Costs."

While it is undoubtedly true that labor must come down—if indeed it has not already come down—to something approaching pre-war levels, and I believe this is true whether we like it or not, it still remains, as your editorial points out, an indisputable fact that the greatest opportunity for economy in manufacturing is to be found in careful regulation of non-productive costs.

Take the matter of small tools, such as milling cutters, reamers, twist drills, taps, chasers, etc. These represent no inconsiderable element of non-productive cost in most plants. Who has not seen production of such tools more than doubled by the simple expedient of properly grinding them? The direct labor cost can usually be cut by virtue of the fact that a perfectly ground small tool will stand more rapid production speeds. The non-productive cost entailed in regrinding, which involves not only the actual grinding time but the stoppage of production as well, will be materially reduced by the use of properly ground tools.

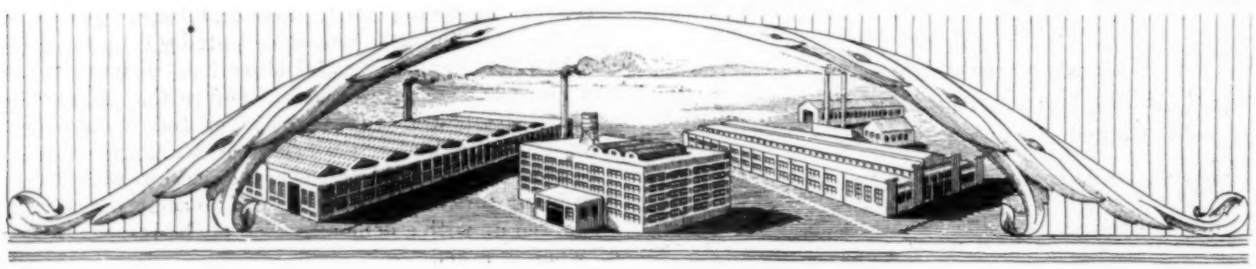
Another element usually charged as a non-productive cost is spoiled work. Particularly in the case of taps, chasers, and formed cutters, this feature of spoiled work is quite an item, and it can be almost totally eliminated by properly ground tools.

Then comes the actual saving in the tools themselves by reduction in breakage. Properly ground tools will stand with safety speeds and feeds that would be suicidal with tools not properly ground.

Of course for the most satisfactory drilling work a high-grade drilling machine is necessary, and it must be equipped with good twist drills. For milling work a high-grade milling machine and a cutter of proper design and high-grade material are necessary. The same is also true as to both machine and tap in the case of tapping work, and machine, die, and chasers for threading work. But, granted all these, and given an imperfect job of grinding the small tools, and your hoped-for efficiency vanishes. Indeed a mediocre machine and inferior tool *properly* ground will give better results than a faultless machine and a faultless small tool *imperfectly* ground.

I feel sure that the above facts cannot be gainsayed, and yet how often do we find careful investigation as to the relative merits of various makes of machines and small tools with the idea of producing efficient operation, and the expected efficiency allowed to slip through the fingers of the purchaser because he does not realize that a chain is no stronger than its weakest link, and that the grinding of the small tools is as important as any other link in the chain. A difference in price of hundreds of dollars is often gladly paid in order to obtain a higher grade milling, drilling, or other machine, and then its performance is reduced to mediocrity by failure to properly provide for grinding the small tools used with it.

If America is to meet German competition in the markets of the world, with the present difference in exchange, we must awake to the fact that it not only takes sharp tools to cut costs, but it takes *properly* sharpened tools, and the old-fashioned hand grinding of such tools must be discontinued. There have been some rapid strides made in the last few years, but there is room for much improvement along this line.



The Layout of a Modern Machine-Tool Plant

Layout of the Foote-Burt Shop—Receiving Material and Shipping Finished Machines—Crane and Monorail Transport—Overhead Hot-Water Heating System

BY FRED H. COLVIN
Editor, *American Machinist*

THE layout of the Foote-Burt plant has a number of interesting features as shown in Fig. 1. The building is rectangular and of the general dimensions given on the plan view which shows the layout of the different departments. A spur track from the New York Central Railroad runs between the boiler house and the shipping department and presents a convenient method of both receiving and shipping material. The chip storage bins are conveniently arranged; for the importance of rapid and economical handling of material has been carefully considered as can be seen both from the layout of the plant and the illustrations showing the cranes and other methods of handling.

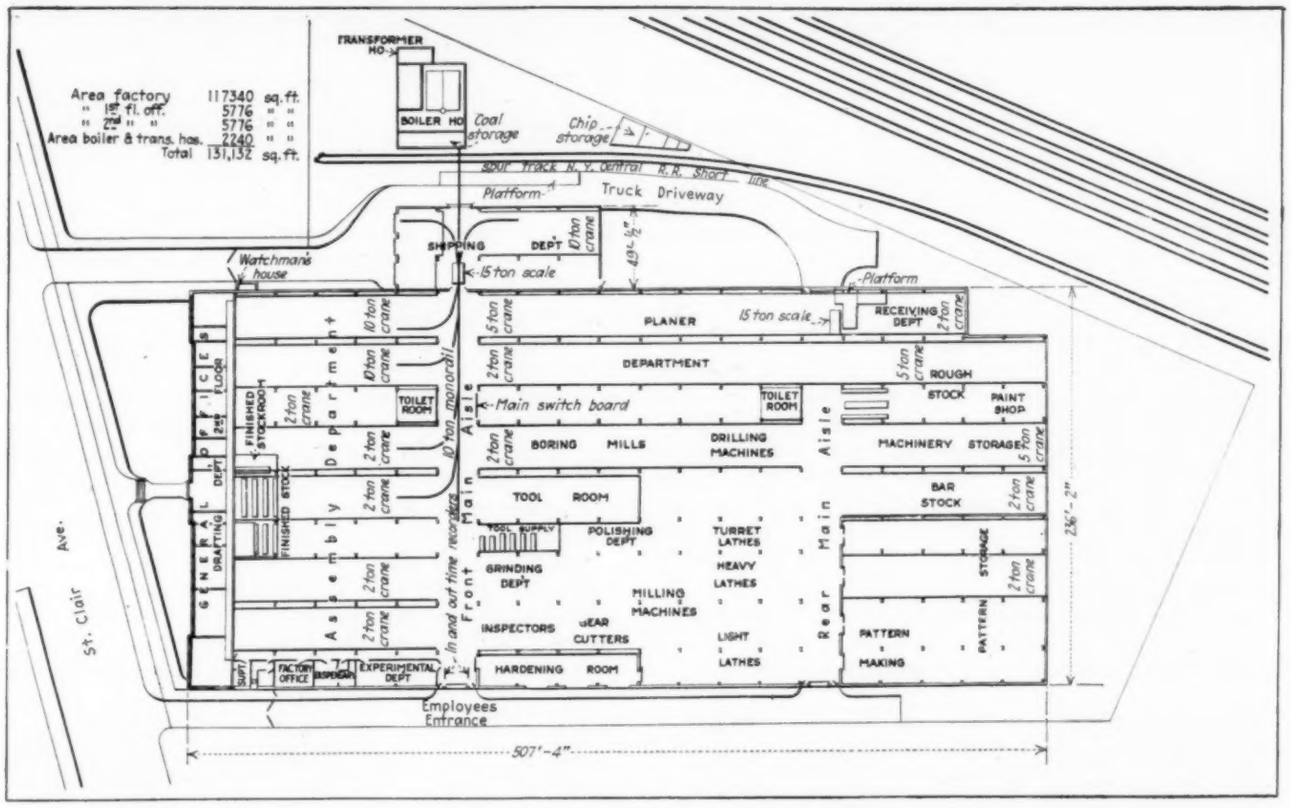


FIG. 1. LAYOUT OF FOOTE-BURT SHOP

In Fig. 2 is shown a view in the shipping department showing the platform, which is of the proper height for loading trucks. Overhead is a substantial mono-rail with a carrying capacity of ten tons, and provided with two 7½-ton electric hoists. This monorail extends out of the shipping department, across both the platform and the spur track and is supported at its outer end just outside the coal storage. In this way it can handle incoming material from the car to the first shop bay where a 5-ton crane can carry it to the receiving department, or it can load finished machines either on a truck or train.

Material delivered to the plant by truck goes around the driveway beside the railroad and is delivered to the platform in the receiving department. The platform is of truck body height and has a ramp so that the small electric shop trucks can handle the material to the rough stock and storage department. Scales weighing up to 15 tons are provided in both the receiving and shipping departments so that both the weight of the raw material and the shipping weight of finished machines can be easily and accurately secured.

Castings that require planing, are handled by the cranes direct to the planer department, the four cranes in this bay handling everything up to front main aisle. Adjoining the planer department are the boring mills and drilling machines, operations on which usually follow that of planing.

Next to this bay is the toolroom and adjoining it the tool supply or toolcrib which is centrally located considering the demand for tools. The space near the toolroom is occupied by turret lathes, milling machines, engine lathes, gear cutting and grinding machines.

The departments are so arranged that the work goes from the stores, through the various departments in as steady a flow as possible. The variety of work makes it impossible to avoid all back-tracking, but this is reduced to a minimum by the layout shown.

The inspection department is near the hardening room and just across the aisle from the assembly department, which runs across the whole front of the shop, directly

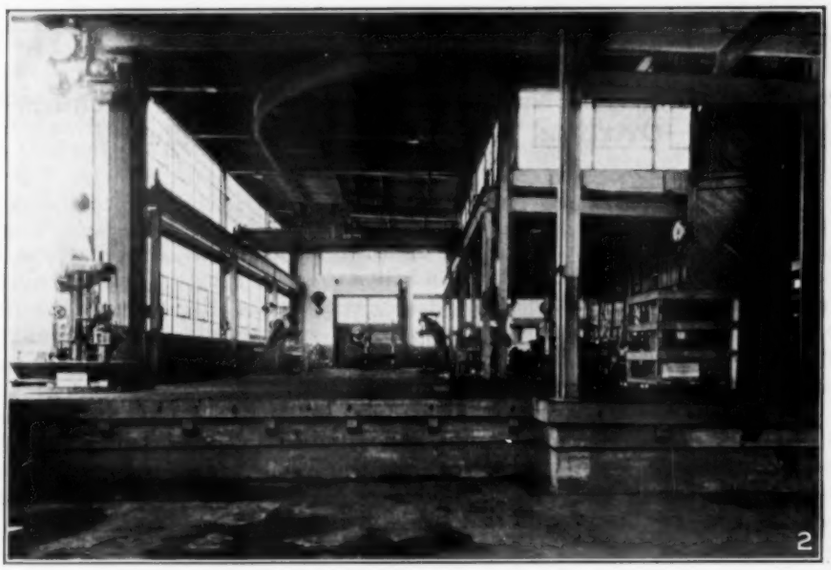


FIG. 2. THE SHIPPING PLATFORM. FIG. 3. HANDLING MACHINES FOR SHIPMENT

behind the offices. This department also contains the finished stock, from which completed units and other materials can be drawn for assembly.

The assembly department is served by four 2-ton cranes for the smaller machines. The heavy machines are assembled under the high bay just across the front main aisle from the planer department. Here one of the runways has two cranes, a 2-ton and a 10-ton, while the other has only one 10-ton crane.

The shop layout shows how the overhead mono-rail serves the front main aisle and also four of the front low bays in the assembling department. Fig. 2 shows the large crane in the shipping department together with both of the 7½-ton monorail hoists in use. One has just carried a machine mounted on skids to await the arrival of a flat car while the other has just deposited a crated machine on the 15-ton scale in the shipping platform.

In Fig. 3 the uncrated machine is still in the doorway but the crated one has been run around the curved rail so as to be easily loaded on a motor truck backed up to the platform. Fig. 4 shows the monorail and crane equipment just inside the shipping room door, in the high bay containing the planer department.

There are four cranes serving this department, two of 2-ton and two of 5-ton capacity. Three of these cranes and the two monorail hoists are shown in the foreground, the 2-ton crane in the small bay being over the receiving department.

The front main aisle, as viewed from the shipping platform, is seen in Fig. 5. This shows the scales, the monorail, and the heavy doors which close the shop away from the shipping department. It also shows a few lockers, sloping on top which prevents the accumulation of dirt and articles of various kinds.

Further reference to the shop layout in Fig. 1 will show the arrangement of the different departments, the rough stock, machinery storage and bar stock occupying adjoining space. The bar stock racks shown in Fig. 6 are all made so that the uprights can be moved to any desired position on the base rail. The height and strength of the pipes forming the racks are proportioned

FIG. 4. WHERE CRANE AND MONORAIL MEET. FIG. 5. THE FRONT MAIN AISLE

to the load they are to carry. The height of the pipes is limited so that it is impossible to overload any rack.

The shop is heated with a hot water system having a forced circulation. The radiators, however, are so

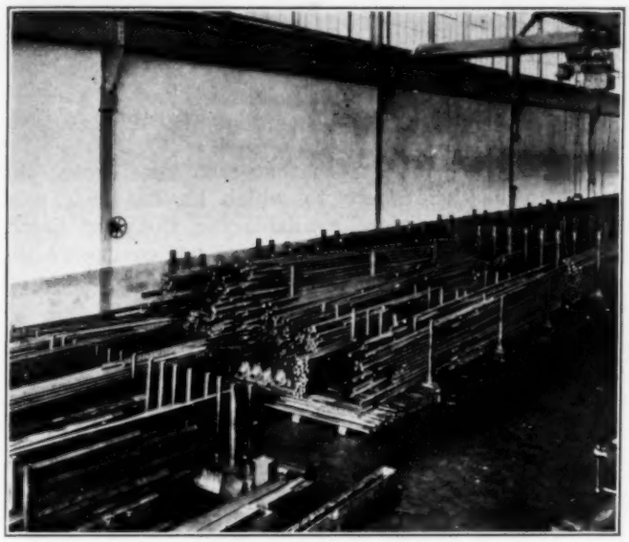


FIG. 6. THE BAR STOCK RACK

carefully concealed by the crane runway gearing as to be almost invisible. They can be barely seen at *A* and *B* in Fig. 4, just beneath the windows and between the crane-ways. The temperature is controlled by the engineer in accordance with the accompanying table. It will be seen that this table takes into consideration whether the plant is running or not, and also the condition of the weather as to wind.

TEMPERATURE OF WATER FOR HEATING SYSTEM AT VARIOUS OUTDOOR TEMPERATURES

No. of Boilers			Water Temperature	
Factory Running	Factory Shutdown	Outside Temperature	Factory Running	Factory Shutdown
		65	70	...
		60	75	...
		55	85	70
		50	90	75
1	1	45	100	85
		40	110	95
		35	120	105
		30	130	115
		25	135	120
		20	150	135
		15	160	145
		10	170	155
2	2	5	180	165
		0	190	175
		−5	200	185
		−0	210	195
		−15	220	205

Note.—In very windy weather carry temperature of water 10 deg. higher than table.

Taken altogether this plant is very complete. One of the outstanding features is that it is of standard construction so as to allow necessary changes to be readily made from time to time. Being laid out with this in view, it could be readily adapted to any other type of machine work or any modification of its present product.

Thoughtlessness in Design of Auto Details

BY FRANK C. HUDSON

If Prof. Sweet had driven an automobile his list of "Things That Are Usually Wrong" would have been much longer. The main "thing" however seems to be the designer who delights in seeing how "close" he can locate nuts and bolts and still get them in—while the body is off and the next piece hasn't been put in place. After the car is assembled you can't always even see where they are. And when something breaks while you are driving with your best girl and your Sunday-go-to-meeting-clothes, you're out of luck. If you said the things you feel, you'd probably be minus a girl, too.

The other Sunday, my clutch decided to reform and give up its fast and loose ways. I tried to release it in traffic and found it had decided to stay right where it was. A little quick action, double-handed work with ignition and brake, kept me out of jail, but left me twenty miles from home. After an hour's tinkering I coaxed it back into action by a temporary repair and started home—and then my real troubles began.

A clevis pin had worked out because the cotter points broke off and I had to find a substitute. I first spied a similar pin in my emergency brake connection and thought I'd steal that, drive slowly and depend on the service brake. But the designer had very thoughtfully prevented this by making this pin $\frac{1}{8}$ in. too short for the clutch clevis. He was some little preventer, but it caused me a lot of trouble because he'd made the clearance so small that you had to find just the right shaped bolt to go in.

Another cause of the trouble was the working loose of the clutch arm on the shaft because some garage

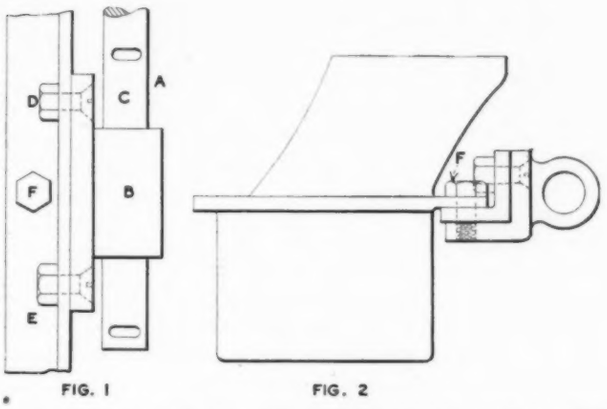


FIG. 1. THE WAY IT LOOKED IN THE BOOK. FIG. 2. THE WAY IT REALLY WAS

man had left the key out and depended on a clamp bolt. This had been strained so that the head came off when I touched it, and this had to be drilled out. Of course it was the inside arm on the clutch shaft at *A*, Fig. 1, which meant that the bracket *B* had to come off to get the arm itself off.

The instruction book showed just how the bracket was held, see Fig. 1. It looked easy even if the clutch shaft *C* prevented getting at the conehead screws *D* and *E*. And the book quite forgot to show that the upper part of the transmission case, which was fastened to the same crossmember, covered the capscrew *F* most effectively.

A little gentle persuasion with a not-too-sharp cold chisel of long and narrow proportions finally loosened the capscrew *E*, and after many trials and tribulations the job was done. But it could have been made very much easier by a little forethought on the part of the designer. If the designer of this had to do the same job, he'd get a better appreciation of real designing than he seems to have at present.

Machining the Wrigley Automobile Transmission Gear

I. Modern Production Methods in an English Plant—How the Progressive Operation System Works in This Shop—Forms Necessary for Accurate Record-Keeping

By I. W. CHUBB
Editor, European Edition, *American Machinist*

E. G. WRIGLEY & CO., LTD., Soho, Birmingham, Eng., in the production of gear cases, back axles, etc., which it provides for the Angus-Sanderson motor car, has adopted a progressive machining system, put in under the supervision of F. G. Woolard, in which a given part or unit is passed under the operation of a series of machines until the machining on that part or unit is finished.

A line of machines is therefore arranged irrespective of class of operation, but so that each operator, whether on one machine or in a subgroup of machines, takes the same time as the man immediately in front of and the man behind him; or if the machining process takes too much time but cannot be divided as a process between two machines, the whole output is divided between two machines so that the output from the line of machines is maintained. In electrical language, the machines are then in parallel instead of in series. But this is exceptional.

One advantage of the system is that the amount of material going through the shops at any time is reduced very markedly. In the case of the firm this is divided by something like 30. Thus, whereas in the ordinary system of machining about 300 boxes would be in progress simultaneously, with the line system only about 10 are going through at the same time. If one machine is stopped owing to breakdown, the whole section stops and clocks off, standing idle. Apart from anything else, this draws forcible attention to the breakdown.

At the beginning, and then only, a number of boxes are part-operated up to each step in the line. Consequently, when operation really commences, each man starts with a single part machined up to the previous operation, except the first operator, who has a complete batch of unworked material. When this operator finishes the last pair in his batch he does not clock off, but waits until the inspector receives the number of completely machined pieces making up the batch. All the men in the section then clock off simultaneously and, a further batch of parts being available, the foreman clocks on the whole section anew.

Time and Cost Keeping by Lots

On reflection it will be seen that the fact that a batch has been completed does not mean that the last piece handled by the first operator has been received by the inspector. As the first operator started with a complete batch the job will, at the moment of completion of batch, be left so that each man except the last man has one piece to which he has just paid attention and therefore available for the next batch. The first operator consequently does not commence the second batch until he has been clocked off the first lot and then clocked on again to the new set. A line section implies the availability of a substitute who can work any one of the machines in the line. He may be a charge-hand or a toolsetter, and he takes the place of an operator who is away from his job for any reason. In such a case the section operator is clocked off and the work he finished entered on his job ticket, the substitute clocking on to a supplementary ticket, which will then show the number of pieces produced by the substitute. As regards pay and penalties for scrap, the substitute is in the same position as the original operator.

Inspection takes place as the part comes from the final operation and is made in the order of operations. Each part, perfect or otherwise, is in fact inspected for all operations because more than one operation may be a scrap operation, carrying the penalization of more than one operator. Scrap is recorded on section inspection sheets (see Fig. 1) in the column indicating the operation, a cross showing whether it is operator's scrap, faulty material or rectification calling for special operation, and the attention of the section foreman is immediately drawn to the matter so that the remedy also may be noted. Otherwise the whole section must be clocked off and must remain idle until the error,

SECTION INSPECTION SHEET

DESCRIPTION	DRAWING PART No.	BATCH No.	PRODUCTION ORDER No.	BATCH QUANTITY	DATE
Gear Box	1565/3/1	C 1214	13/AA	100	7/10/20

OPERATION Nos.	1	2	3	4	5	6	7	7a	final Insp.	TIME ALLOWED PER BATCH
MACHINE No.	556-535	682 749	720	799	55.58 Ref. No. 515	443	—	—	—	TIME STARTED
DAY OPERATOR'S No.	4011	4006	4009	4003	4010	4016	4017	4015	4013	TIME FINISHED
NIGHT OPERATOR'S No.										TIME SAVED
JOB TICKET No.	3858	3859	3860	3864	3865	3866	3867	3868	3869	
SCRAP	OP. SCRAP	F.M. SCRAP	MTL. OP.	OP. SCRAP	F.M. SCRAP	MTL. OP.	OP. SCRAP	F.M. SCRAP	MTL. OP.	OP. SCRAP	F.M. SCRAP	MTL. OP.	OP. SCRAP	F.M. SCRAP	MTL. OP.	OP. SCRAP	F.M. SCRAP	MTL. OP.	OP. SCRAP	F.M. SCRAP	MTL. OP.	RESULTS
				X			X				X							X			X	Total Pieces 96
							X											X			X	1 Extra 3
																		X				F.M. Scrap 1
																		X				Mtl. Op. 5
																						Total 100
INSP. SLIP No.	5222	5223	5224	5225	5226	5227	5228	5228														
F.M. SLIP No.						5407																
O/. SCRAP SLIP No.			8469	8470																		
SPLIT BATCH SLIP								1444														

INSTRUCTIONS

THE INSPECTOR WILL INSPECT EACH PART AS IT COMES OFF THE LAST OPERATION IN THE ORDER OF THE OPERATIONS. EACH PART IS TO BE INSPECTED FOR ALL OPERATIONS EVEN THOUGH ONE OF THE INITIAL OPERATIONS IS FOUND TO HAVE SCRAPPED THE PART.

SCRAP WILL BE RECORDED BY PLACING A X ON THIS SHEET IN THE COLUMN UNDER THE OPERATION IN WHICH IT WAS FOUND ACCORDING TO WHETHER IT IS OPERATOR'S SCRAP, FAULTY MATERIAL SCRAP, OR RECTIFICATION REQUIRING SPECIAL OPERATION. THE SECTION FOREMAN'S ATTENTION IS TO BE IMMEDIATELY DRAWN TO THE MATTER.

E.G.W.& Co. 330

FIG. 1. BATCH INSPECTION RECORD SHEET

if not arising from faulty material, has been rectified. Scrapped parts, whatever the reason, are piled until completion of the batch and do not pass to the stores until the job ticket inspection slips and scrap slips (referred to later) have been made out. When a batch has been completed, the inspector receives from the section foreman all the job tickets clocked off, the result of each operation then being entered on the corresponding man's job ticket from particulars of scrap previously entered on the section inspection sheet.

Method of Figuring Bonus

A reference has been made to the section inspection sheets employed. For departmental purposes these sheets are summarized to show scrap, times allowed and taken, and bonus rate paid. This sheet is used by the inspection department to accumulate results of a batch which may perhaps take a week to get through a line section. When the batch is completed, the inspector then makes out an inspection slip (Fig. 2) for each operator. This latter form is in triplicate, of which one copy is passed to the record section of the inspection department while the second copy is passed for checking purposes to the clock office and on to the works office where the progress records are marked up accordingly. The third copy, which consists of a card or tag, is not used by the line section, the finished parts being passed into stores on a stores inwards voucher. The reason for the card copy of the inspection slip is to provide for the identification of the batches after one operation and until picked up on the next operation, where such batches move about the shop and are not handled by the line section method now being described.

The checking of the inspection slip copy with the job ticket is a very necessary operation as this prevents mistakes arising in the payment of bonuses and in the correct recording of progress.

In the case of the job ticket (Fig. 3), one is made out for each man by the progress department and the whole lot are issued to the foreman concerned with the line section. This job ticket consists of two flimsies (thin sheets) and a card, the top half of the flimsy form being a reproduction of the top half of the front of the card down to and including "Timed to start" and "Timed to finish," but below this instructions are given on each flimsy. The flimsies of the job ticket are used for the following purposes: The top one is passed by the foreman to the assistant foreman to enable him to arrange for the necessary material to be available pending the completion of the job then being operated upon. It is subsequently handed to the operator for his information. The second copy of the job ticket is primarily used as a check by being handed in by the foreman to the clock office when the job tickets are withdrawn after being clocked off, to have the particulars of the operation entered thereon. The clock office thus has a direct check of all job tickets which pass out of its possession temporarily.

The results entered on the job card by the inspector form the authority for the payment of bonus.

With regard to scrap, when this is due to faulty material, a faulty material scrap slip (Fig. 4) is made out by the inspector on the section. This form consists of two flimsies and a card copy. After being made out and the number of the slip recorded on the inspection slip, the two flimsies are distributed as follows: The first copy is passed to the record section of the inspection department, where it is duly entered up and filed for reference. The second flimsy accompanies the parts returned to stores, forming a stores inwards voucher, and on this flimsy the store keeper enters the weights of such material and passes it on to the stores recording department. The card copy is attached or placed with the goods and remains with them as identification until they are returned to the supplier or otherwise disposed of.

In the case of scrap due to faulty machining, an operator's scrap slip (Fig. 5) is made out. This form also consists of two flimsies and a card copy and the distribution is the same as for the faulty material scrap slip.

When part of a batch requires special operation which cannot be performed upon the line section, a split batch slip (Fig. 6) is made out by the inspector on the authority only of the progress department. This form consists of one flimsy and a card copy, the former being passed to the progress department, giving the number of parts and the reason for having split such parts away from the batch; the second or card copy

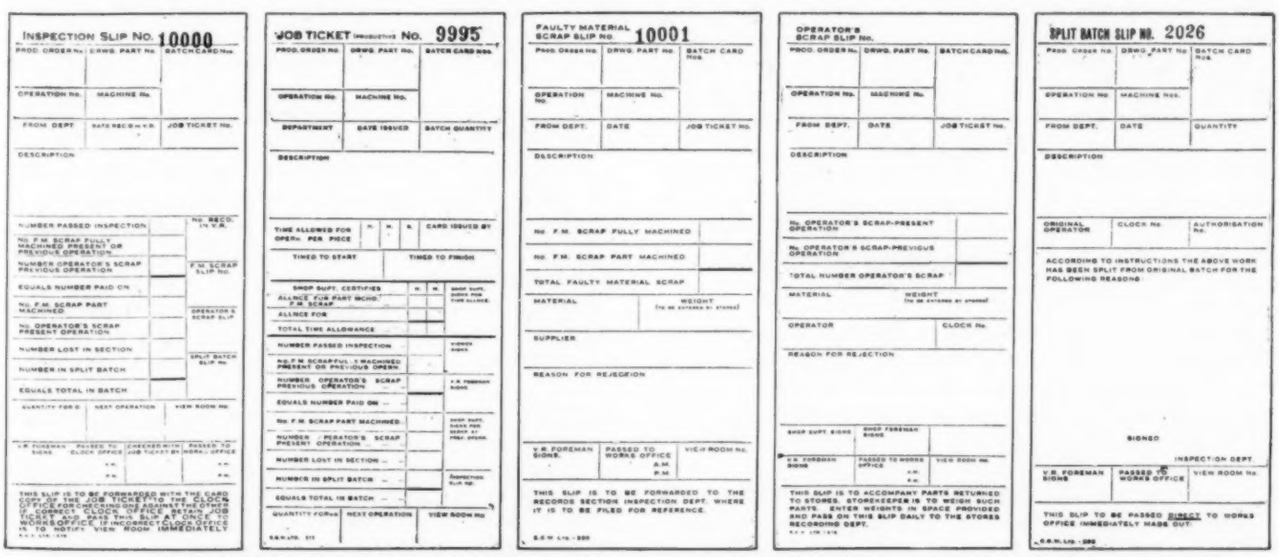

INSPECTION SLIP NO. 10000
JOB TICKET (INSPECTION) NO. 9995
FAULTY MATERIAL SCRAP SLIP NO. 10001
OPERATOR'S SCRAP SLIP NO.
SPLIT BATCH SLIP NO. 2026

FIG. 2. INSPECTION SLIP MADE IN TRIPLICATE FOR CLOCK OFFICE, PRODUCTION OFFICE AND STORES
FIG. 3. INSTRUCTIONS ON THIS FORM MAKE IT SELF-EXPLANATORY. FIG. 4. FAULTY MATERIAL SLIP
FIG. 5. SCRAP SLIP. FIG. 6. SPLIT BATCH SLIP

is attached or placed with the job which is passed to the desired section of the works, where it can be identified and picked up by an additional job ticket issued by the works office.

Returning to the shops, as quantities of the finished parts are available they are passed to the finished stores, each lot bearing the stores inwards voucher which states the section, production order number and symbol batch number, date, part number and quantity. The scrap parts, whatever the reason, are piled until completion of the batch and then sent to the stores, where the inspection and scrap slips are made out. With the last of the batch the inspector receives from the foreman all the job tickets clocked off, and the result of each operation is entered on the corresponding man's job ticket, the scrap made being shown on the scrap section inspection sheet. An inspection sheet is made out for each job ticket and also, if necessary, scrap slips. The appropriate inspection slip is then clipped to the section inspection slip and sent to the works office, the other inspection slip being passed to the clock office with the job ticket.

Overtime and Scrap

All inspection tallies are passed to the records section of the inspection department. Where rectification is necessary to a part it has to go back to the operator responsible, who works overtime if necessary. Further, if the work accumulates at any given machine overtime may be necessary. It is found, as a matter of fact, that if a man is behind with his work the other men give him a hand. For the premium bonus earnings in a given section the men are limited by the slowest operator, but each individual man concerned is separately penalized for scrap, which does not affect the other men in the section. Whenever an operator works overtime the extra time is clocked on his job ticket and is not booked against permanent order.

In the case of special rectification, operations outside the section may be necessary. The pieces thus to be dealt with are isolated, numbers are entered on the job ticket and the inspection slip giving the number split and a split batch slip are made out. A special job ticket for the split portion is then issued by the works office for the other department of the works. Where the rectification arises from faulty machining, the parts are charged against the operator as scrap, no payment being made. Particulars are entered on the section inspection sheet. Where the special operations arise from faulty material, the work must not be done without direct authority from the works office. The pieces are sent back by way of the stores to the supplies.

How Would You Machine This Disk?

By Service Engineering Co., Inc.

In an article under the above title on page 959, vol. 54, of *American Machinist*, P. Arter asked for the solution of a problem in machining a brass disk.

It appears to me that the quantity in which this disk is to be manufactured largely determines whether it would pay to build a substantial fixture.

In my estimation this is one of the points a designer should know and one that Mr. Arter omitted.

[From the title of the article under discussion, we assume that there was only one disk to be machined.—Editor.]

Machine Tool Depreciation

By Ernest F. DuBrul

General Manager, National Machine Tool Builders' Association

On page 49 of the *American Machinist* L. L. Thwing, in discussing the question of machine shop depreciation, seems to miss the point. In the first place, the accounting plan in which the rates were recommended was not presented as a plan for all machine shops. It was presented as a plan for machine tool shops, and this recommendation as to depreciation rates is not intended to cover mere wear and tear, as Mr. Thwing's article indicates as the only element of depreciation.

The rates recommended to the Machine Tool Builders' Association were arrived at after very thorough discussion in five regional meetings, at which representatives of about 130 different concerns were present. It was felt that the machine tool industry must keep itself up to date in its equipment for a number of reasons.

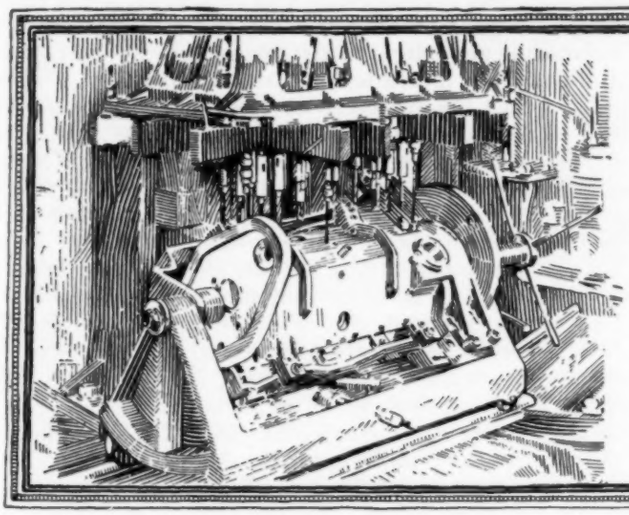
First, because the accuracy of machine tools must be maintained in a machine tool shop to a high degree. Second, the economic conditions surrounding the production of machine tools makes this industry peculiarly subject to fluctuations, and therefore careful management will figure into costs just as much of the experience of the industry as can properly be figured into them. Third, just as a bridge designer does not erect his structure with material only sufficient to carry the theoretical load, but allows a liberal margin in the way of factor of safety for an extra load and also for failure of the material to quite reach the utlimate tensile strength, so it is necessary for an irregular industry like machine tools to figure a financial margin of safety.

A screw planer made in 1844 might conceivably be preserved in a machine-tool shop as a museum specimen, but no machine-tool manufacturer would feel that any but the most modern planers would be suited to machine-tool work. This illustration of Mr. Thwing's is unfortunate in that he cites a lot of plants that are not high production plants—plants in which some old equipment that would be obsolete for their purposes might possibly be worth keeping where they stand. Even Mr. Thwing's citation of the shafting in the packing house states that the demands on his shafting were not very severe, so that the mere existence of this old equipment must not be taken as typical experience. It would not be safe experience in a machine-tool shop.

Shafting, pulleys, etc., are not much of an asset when frequent changes demand removal, and his objection, therefore to the rates recommended falls to the ground in the experience of the machine-tool industry.

It may be that in some other industries shop furniture such as benches and trucks will last as long as twenty years, but this has not been the experience in the machine-tool industry, especially in view of new improvements which will continue to take place.

One must not forget, in discussing the machine-tool builders' plan, that this is intended to provide for obsolescence, and to be in point, all criticisms of the depreciation rates recommended must bear that fact in mind as well as the fact that this is a plan for machine-tool shops. Perhaps if other industries as a whole would make as careful and thorough a study, and discuss their questions from these points of view as the machine-tool builders have done, they would find that many impressionistic depreciation rates are so low as to jeopardize real profits when they are figured into costs, upon which prices, of course, ultimately rest.



Tool Engineering

By

Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Milling Fixtures Continued — Supporting and Clamping Thin Castings — Principles and Methods of Pneumatic Clamping — Fixtures for Hand-Milling — Form-Milling Attachments

IN milling thin work it is important that it be held in such a way that vibrations will not be set up during the cutting operation. An efficient method of holding a piece of this kind rigidly, yet without distortion, is shown in Fig. 132. The work *A* is a deep, thin bronze casting which is to be milled along the upper part of the flange *B*. The work is located on suitable supports under the flange, in the V-block at *C* and against the locating block *D*. It is clamped as indicated by the arrows at *E* and *F*. The clamping action will obviously tend to distort the sides of the casting and as there are no lugs on the work to which clamps can be applied, the results would be very unsatisfactory. The writers have seen a fixture of this kind in which it was impossible to machine the work without distortion; in fact it was difficult to machine it at all on account of the "chatter" induced by the vibrations of the thin metal walls.

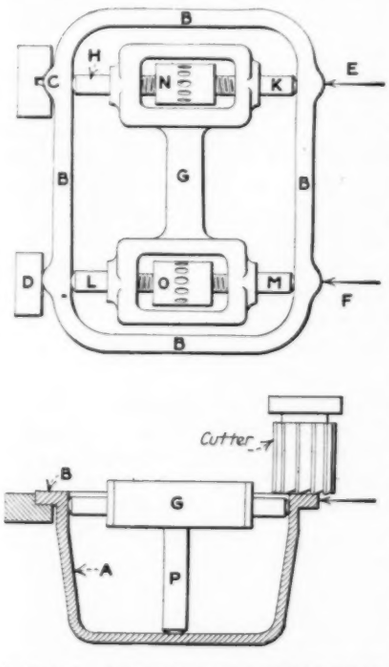


FIG. 132. METHOD OF SUPPORTING AND CLAMPING A THIN CASTING

A remedy which was suggested and applied successfully is indicated at *G*. This is a "spider" of aluminum having two supporting studs *P* which rest on the bottom of the casting. At *H*, *K*, *L* and *M*, screw jacks are located, directly opposite the outside locating and clamping points.

When setting the work in this fixture the outside clamps are first set up very lightly and locked in position. The spider *G* is then set inside the work and the screw jacks set up tightly by means of the nuts at *N* and *O*. As the jacks are directly opposite to the outside holding and locating points a metal-to-metal contact is obtained which does not distort the work, yet holds it firmly so that all vibrations are "killed" and the piece can be milled with speed and precision.

The principles illustrated in this example can be applied in many similar cases. It is well, however, to note that a much better way of finishing a casting of this sort would be by using a surface grinding machine instead of a milling machine.

An excellent fixture, which was designed for holding the work *A* while milling the circular form *D*, is shown in Fig. 133. The work has been previously finished in the hole *B* and also on the sides *E*. It is evident that the action of a large form cutter such as that used in

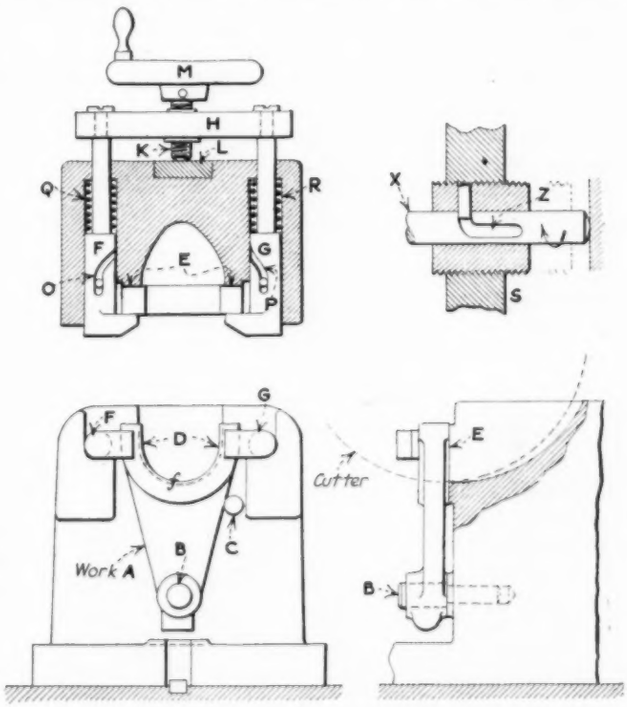


FIG. 133. FIXTURE WITH EQUALIZING HOOK BOLTS

For the authors' forthcoming book. All rights reserved.

milling the contour *D* necessitates exceptionally rigid support for the work in order to eliminate "chatter" during the operation. The work is located on a stud at *B* so that it rests against a solid surface at *E* and is

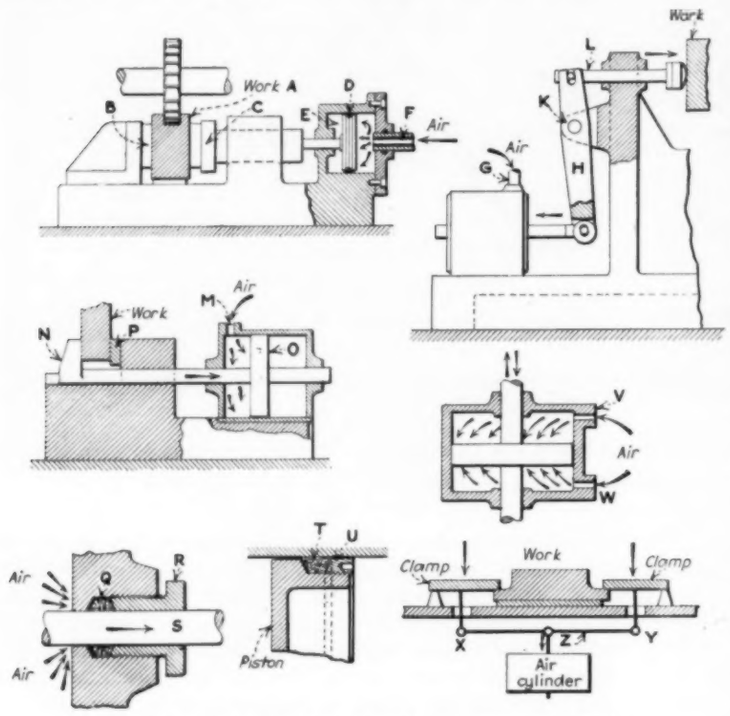


FIG. 134. PRINCIPLES OF PNEUMATIC CLAMPING

located in the other direction by the pin *C*. It is clamped back against the shoulder *E* by means of the hook bolts *F* and *G*, these being operated by the equalizing bar *H* through the action of the hand wheel *M* and the screw *K*. The latter works against a hardened block at *L*.

The hook belts are provided with camslots at *O* and *P* which are so located that when the pressure of the spring at *Q* and *R* is exerted after the handwheel is loosened, the hook bolts turn 90 deg. and are thus out of the way so that the work can be readily removed. In other words, when the hook bolts are pushed out away from the work by means of the springs, a pin in the campath makes them revolve in the manner noted. An additional refinement can be used as shown at *F*, if conditions warrant it, by mounting the handwheel on the shaft *X* in which a bayonet lock *Z* is cut. A method like this would make the operation of the mechanism somewhat faster than the example previously described. The advantages of this type of fixture are the extreme rigidity that is obtained and the fact that the operator is not obliged to put his hands near the cutter. It is rapid in operation and the construction is such that the upkeep is very economical. The use of air-operated chucks and other clamping devices is becoming more and more general for work requiring careful holding or rapid operation. The majority of present day factories are equipped with air compressors and pipe lines extending to the various departments of the shop. With such equipment, advantage should be taken of the opportunities for using air pressure to operate fixtures of various kinds.

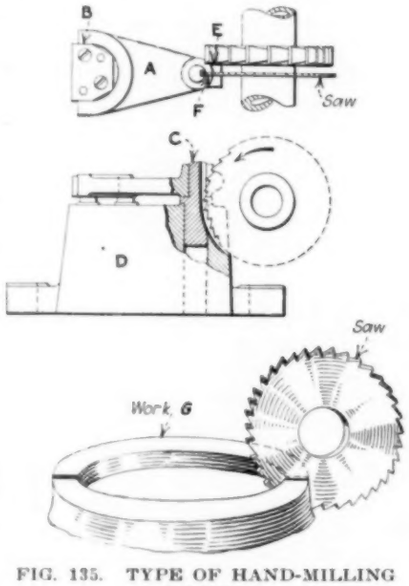


FIG. 135. TYPE OF HAND-MILLING FIXTURE

Fig. 134 shows a few diagrams which will assist the designer in understanding the principles of pneumatic clamping. The work shown at *A* is being held for the milling operation indicated between the jaws *B* and *C* of a pneumatic holding fixture. The air cylinder *E* is a part of the fixture itself. The air enters the chamber at the port *F* and acts upon the head of the piston *D*, which is coupled to the sliding jaw *C*. The operation of the mechanism is very simple as it only requires the turning of a lever to admit or release the air. The amount of power developed is determined by the pressure carried in the pipe line *F* and the diameter of the piston *D*. Increased power can be readily obtained by the use of compound levers, bell cranks or similar appliances.

In another example the air enters the cylinder through a pipe at *G* and acts against a piston connected to the lever *H*. This lever operates a sliding rod at *L*, applying pressure in the direction indicated by the arrow. The amount of leverage obtained is dependent on the position of the fulcrum pin *K*.

Another diagram shows the piston connected to a hook-bolt *N* in order to clamp the work against the locating surface *P*. The air enters the cylinder at *M*, acting against the piston *O*.

A point of great importance in connection with the use of air pressure for operating various devices, is the matter of packing to prevent the escape of the air and consequent loss of holding power. Lubricated asbestos packing is frequently used in connection with suitable glands as shown at *Q* and *R*, the packing being drawn tightly around the shaft *S*. A method of packing a piston is shown at *T*, the packing being compressed by means of an annular ring-nut *U*. It is evident that air must frequently be applied in both directions in order that a piston may operate effectively. The diagram shows two ports at *V* and *W* which can be closed and opened alternately as required, by means of a valve.

Pneumatic clamping can be applied through equalizing devices of various kinds; one of which is shown in diagrammatic form. Here the air acts on the equalizing lever *Z* through the air cylinder in such a way that the pressure acts uniformly at the points *X* and *Y*, thus operating the clamps. To the designer of high production tools the possibilities of air clamping should be given the most careful consideration, and in particular cases where it is desirable to operate a number of clamps simultaneously with a uniform pressure it may often be possible to adapt pneumatic methods to advantage.

Hand-milling fixtures can be used profitably on small

light work requiring high production, providing the cuts to be made are short so that the operator is not required to feed the work by hand any great distance. A good example showing the principles of a hand-milling fixture is shown in Fig. 135. The work *A* is located on the half-bearing *B* at one end of the fixture and is supported at the other end on a stud *C* in the body of the fixture as indicated at *D*. No clamps are shown for this piece of work as it is the intention to illustrate here only the principle of down cutting. The work to be done is the facing of the boss at *E* and the cutting of the punch binder slot at *F*. Both of these operations are done at the same time.

When a hand-milling machine having a vertical feed is used, a weight may be hung on the end of the handle so as to make the feeding action automatic. If it is desired to use a fixture of this kind on the other type of hand-milling machine, the work can be fed against the cutter horizontally. An example of a piece of work

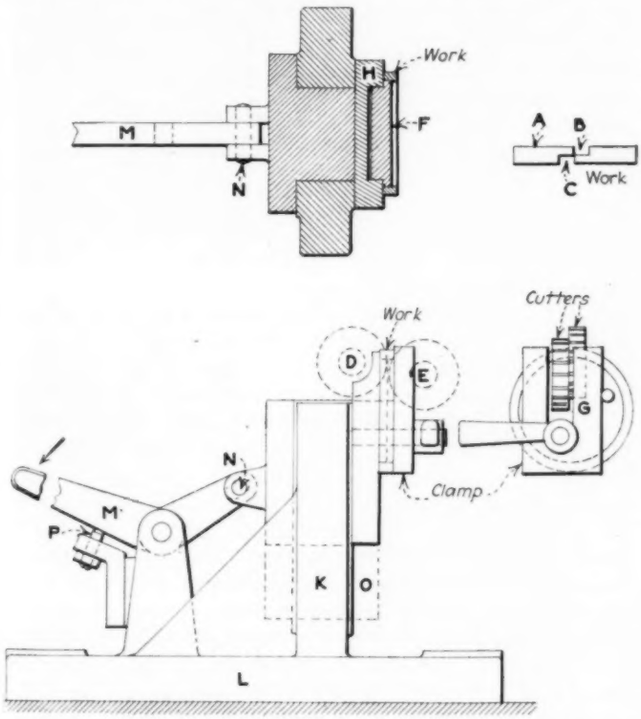


FIG. 136. FIXTURE FOR MILLING A LAP-JOINT PISTON OR PACKING RING

suitable for a hand-milling fixture is shown at *G*. The work is a ring which is to be cut in two by a narrow saw cut as indicated. Rings of this kind can be cut either singly or in multiple, depending upon their thickness and the method of holding.

Cutting a Lap-Joint Packing Ring

The work shown at *A* in Fig. 136 is a lap-joint packing ring which has been turned to a sufficient diameter to allow for the cutting out of the portion *B* and *C*. In order to do this work as rapidly and economically as possible a fixture was designed to be used on a light plain-milling machine in connection with a special head carrying two cutters mounted as shown at *D* and *E*. One of these cutters is mounted slightly below the other so that the cutter teeth will not interfere with each other in their action. The work is mounted on a locating plug shown at *F* and is clamped in place by means of a screw lever on the U-washer *G*. This washer is so located that it will always bear the same relation to the cutters in order to avoid interference with them. The stud *F* is mounted in a slide *H* which is fitted to

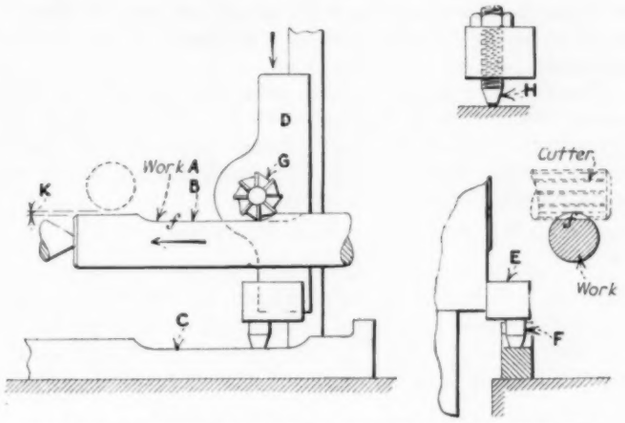


FIG. 137. AUTOMATIC FORM-MILLING ATTACHMENT

the vertical member *K* on the fixture base *L*. A bell-crank lever *M* is attached to the slide by means of a pin *N* in a lug at the back of the slide. Suitable gibs should be provided on the slide to take up wear. In operating the device, the work is placed in the fixture when it is in the position shown by the dotted lines at *O*, then it is fed up past the cutters until the lever *M* strikes the stop pin *P*. The pin may be adjusted to permit the proper movement.

This fixture requires in connection with it a special design of milling head to carry the two cutters *D* and *E*, but as an arrangement of this kind can be easily made there is no objection to its use when the occasion warrants it. It is well to note at this point that when it is necessary to design sliding fixtures which are in continual use, provision should always be made for adjustment of the slide by means of suitable gibs.

Form-Milling by Means of a Special Attachment

A special form can be easily cut on a hand-milling machine by the use of a forming attachment such as that shown in Fig. 137. The work *A* is a shaft having a flat milled on it as indicated at *B*. In order to do this work easily and automatically, a form-plate *C* can be applied to the table of the milling machine in such a way that it will control the movement of the slide *D* by means of the block *E* in which is mounted a forming pin *F*. This pin rides along the form shown at *C* and the cutter *G* being mounted in the head *D* naturally

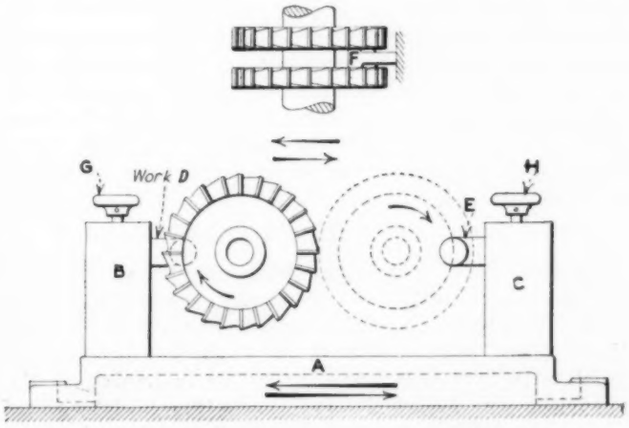


FIG. 138. RECIPROCATING MILLING FIXTURE

follows the outline required. If the head *D* is fed downward by means of a weight, it is only necessary for the operator to place the work in position and operate the feed handle for the table. It is advisable to make the forming pin with an adjustment as shown at *H* in order to take care of variations in the cutter diameter.

The forming plate *G* is so made that it will lift the cutter above the surface of work as indicated at *K* at the completion of the cut. Attachments of this kind can be made cheaply and will handle many kinds of work where a form cut is required.

Reciprocating Fixtures

It is often found an advantage to make up duplicate fixtures which can be so arranged on the milling-machine table that the operator can load one fixture while the cutter is operating on the other. In this manner a great deal of time is saved and the operation is almost

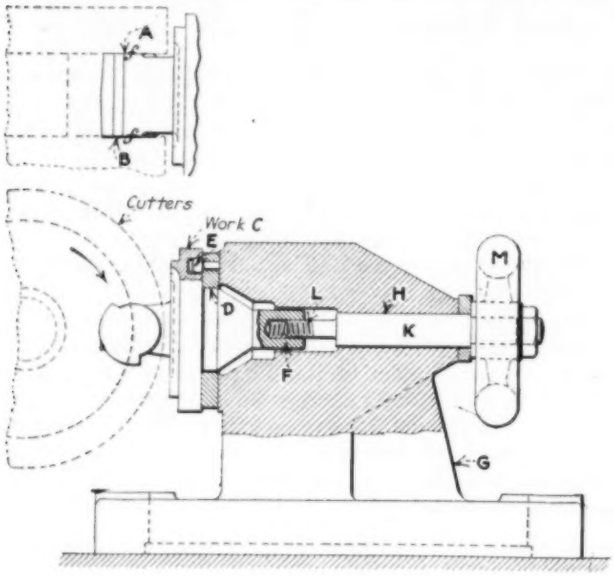


FIG. 139. HIGH PRODUCTION STRADDLE-MILLING FIXTURE

continuous. Fixtures of this kind can be applied to a great many kinds of work and are particularly useful for straddle or slot milling.

A very good example is shown diagrammatically in Fig. 138. Two holding fixtures *B* and *C* are set at opposite ends of the fixture base *A*. The work *D* is shown in process of machining while the piece at *E* is being removed. The cutting action on this piece is shown by the diagram at *F*. The work is held by means of thumb-screws *G* and *H* which operate binding shoes. This particular example is only intended to show the principles involved in the design of reciprocating fixtures, not details of construction. Care must be taken that fixtures of this kind are placed far enough apart so that the operator is not endangered when replacing or removing work.

High Production Straddle-Milling Fixture

Another type of fixture which can be used either singly or in a reciprocating manner is shown in Fig. 139. The operation is the straddle-milling of the surfaces *A* and *B* on the work *C*, which has been partly finished in a previous operation. It is located in the hardened ring *D* and its radial position is determined by means of the pin *E*. The end of the work is threaded at *F* and this fact is utilized in order to obtain a positive method of holding it in position.

The fixture base *G* has a long bearing at *H* in which the rod *K* is a running fit. The end of the rod is threaded at *L* to fit the end of the work and the hand wheel *M* is used to draw the work back firmly into its seat. This fixture is very rigid, is rapid in operation and has given excellent service. Chips often accumulate in the locating seats, making it difficult to hold work and causing other trouble. The fixture shown in Fig. 140 was designed to obviate this chip trouble and the idea may be

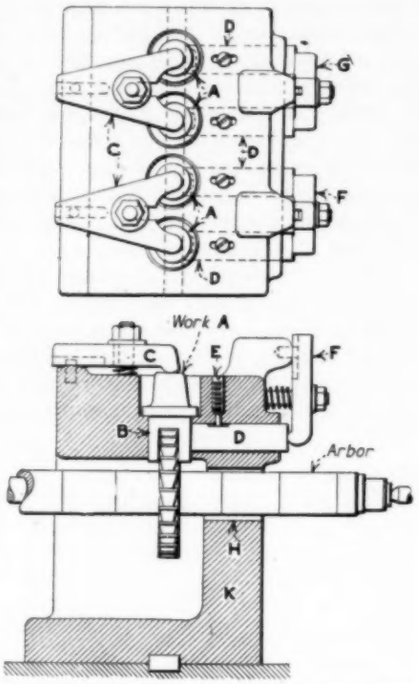


FIG. 140. MULTIPLE MILLING FIXTURE

valuable for adaptation to other conditions. The fixture shown is used for milling the slot in the work *A* from beneath. It may be argued that the cutting action in this case is partly against the clamps, but in reality there is very little pressure exerted directly against the clamps as the thrust of the cut is partly against the surface of the holes in which the work locates. The pieces rest in cylindrical pockets *B* in the body of the fixture and are clamped down by means of the double clamps *C*. Four pieces are held in the same fixture, each clamp being so designed that it will hold two pieces at once. In addition to the hold-down clamps, binder shoes are provided for each piece as shown at *D*. These binders are formed at the end to the shape of the work and are prevented from turning by means of the teat-screws *E*. Two of the binders are operated at the same time by means of the equalizing clamps at *F* and *G*, these acting on the ends of the binders.

Attention is called to the way in which the cutter arbor passes through a cored slot in the body of the fixture at *H*. By passing the arbor through the fixture *K* an out-board support is obtained by means of

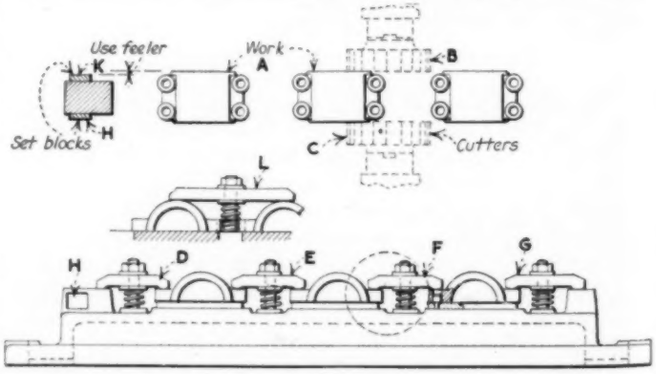


FIG. 141. TYPES OF FIXTURES FOR DUPLEX MILLING

the over-arm on the milling machine, thus making it possible to produce work much more rapidly than could be done with an overhanging cutter. A careful study of this fixture will be of advantage as the principles involved may be found useful in numerous cases where multiple-fixtures are needed. The duplex-milling machine is occasionally used for facing off both sides of work which might also be straddle-milled with large cutters. An example of this kind is given in Fig. 141 and we are citing this case to show the disadvantages and lost time occasioned by a poorly arranged milling fixture. The work *A* consists of bearing caps which are to be machined on each side by the cutters *B* and *C* as indicated. The work is located on a finished surface and on pins in two holes in each cap. Clamps are provided at *D*, *E*, *F* and *G* to hold the work down while milling. Set blocks are also located on the fixture at *H* and *K*, which are used with a feeler to set the cutter. Attention is called to the spacing of the work on this fixture, as the pieces are set so far apart that the cutter is "cutting air" about half the time. In order to save time and increase production, the pieces should be set as closely together as possible. There is no reason why an arrangement such as that shown at *L* can not be used, as the only space necessary in this case is clearance for the bolt and the spring. If arranged in this way more work could be placed on a fixture of the same length and each clamp would hold two pieces so that the clamping action would be more simplified and much more rapid.

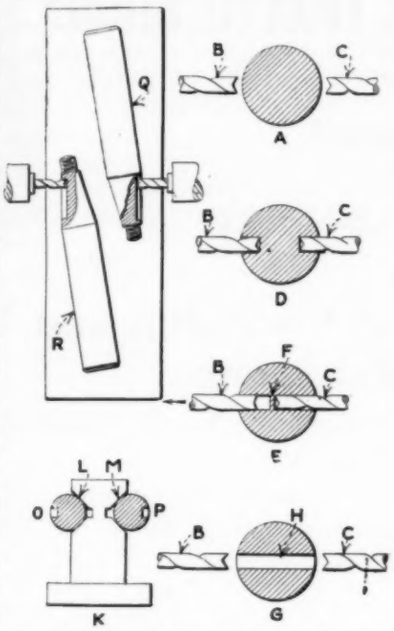


FIG. 142. EXPLANATORY DIAGRAM OF SPLINE AND SLOT-MILLING

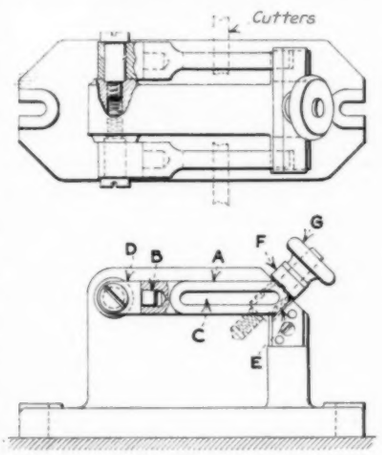


FIG. 143. EXAMPLE OF SPLINE-MILLING FIXTURE

The diagrams shown in Fig. 142 are intended to give the student a better idea of the uses and principles involved in the milling of splines. In designing spline-milling fixtures the first thing for the designer to remember is that the height of the spindle above the table is absolutely fixed and there is no adjustment vertically. Hence the fixture must always be designed to certain dimensions which vary among the different manufacturers.

Several standard fixtures can be purchased as equipment for the machine, these being useful for the holding of plain bars and for flat work. A bushing holder with taper collets to hold standard taper shanks can also be obtained. These fixtures can be adapted for a variety of uses when only a few parts are to be machined, but when a number of pieces of the same kind are to be manufactured, it is usually necessary to design special fixtures in order to obtain uniformity in the product.

Action of Cutters

Several diagrams are given in order to show the cutter action when the machine is in operation. The diagram at *A* shows the cutters *B* and *C* approaching the work and ready to cut. Diagram *D* shows both cutters *B* and *C* part way through the work. Diagram *E* shows cutter *B*, which has approached almost to the center line of the work, withdrawing in the direction of the arrow while the cutter *C* continues and takes out the remaining metal at *F*. The diagram at *G* shows the completed slot at *H*.

As it is absolutely necessary that key-ways be located central with the shaft, any method used for location must take this point into consideration. In the example shown at *K* it will be noted that the V-blocks *L* and *M* are arranged so that the center line *OP* is directly in line with the spindles.

When tapered shafts like those shown at *Q* and *R* in the upper part of the illustration are to be spline-cut they may be set as indicated in order to utilize both spindles of the machine. Shafts having single splines should always be cut in pairs, in order that the machine may be worked at maximum efficiency. Generally speaking, spline-milling fixtures are simple in design and it is, therefore, unnecessary to illustrate many types. The principles given are sufficiently clear to enable a designer to make fixtures of this kind without difficulty.

One example of a spline-milling fixture is shown in Fig. 143. The work *A* has been previously milled on the sides and the hole *B* has been reamed as indicated. The slot *C* is to be machined on the spline-milling machine. Two pieces are held at the same time as shown in the upper part of the illustration, each being located on a swiveling stud *D* by means of a pin which enters the hole *B*. The other ends locate on the angular blocks *E*, being clamped in place by means of the equalizing clamp *F* operated by the thumb-knob *G*. This fixture is very clean in its general appearance and is of simple, though efficient, construction.

MODERN PRODUCTION METHODS

By
W P. Basset
of
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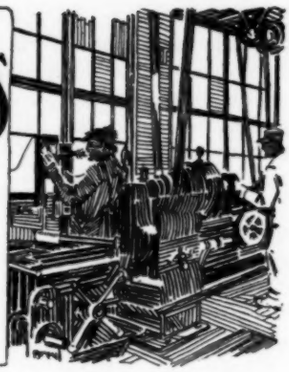


XIX—The Statement of Condition and the Operating Statement

How to Determine Whether the Business Is Gaining or Losing—A Method of Discovering How the Profit Is Made

UNDER the old methods of accounting—which are still far too commonly used—the owner of a business could not know how successfully he was operating without "closing the books"; and "closing the books" was too formidable an adventure, both physically and mentally, to undertake more often than once a year. In the meantime, the business went on hopeful but fearful of what the findings would be when the books were finally closed and the history of the year's operations written.

It would be interesting to describe the cumbersome, laborious process of closing the books—for the sake of ridiculing those old-fashioned methods which gave such meagre information. But those who have been through the process are not apt to forget it.

Now that the way to tie cost accounting into the general accounts of a business has been discovered, it is possible to determine the condition of a business frequently and easily. In fact, the manufacturer can, if he wants, get statements weekly or daily without great effort. But I do not believe they are needed so often. Once a month is, however, not too frequent for an owner or his executives to check up on the activities of a business. The oftener you can check up, the less likely you are to let a loss run on. Too frequent statements, on the other hand, are apt to lack perspective.

TRIAL BALANCE
as of
JANUARY 31, 1921

	Dr.	Cr.
Reserve for depreciation of buildings		$1,319.47
Materials purchased finished	$25,232.02	
Lumber and packing materials	923.80	
Insurance accrued—machinery		112.50
Taxes accrued		183.33
Prepaid insurance—buildings	1,387.80	
Forgings and castings	54,274.62	
General stores	6,126.30	
Selling expense	1,898.45	
Goods finished and in process	26,520.33	
Buildings	452,629.11	
Bar stock	27,341.13	
Hardening and carbonizing materials	4,300.56	
Fuel	5,371.29	
Reserve for depreciation of machinery		3,711.17
Machinery	372,624.64	
Accounts payable		308,214.18
Iron and steel	25,137.47	
Cash	79,204.71	
Accounts receivable	625,326.50	
Real estate	50,000.00	
Surplus		325,966.52
Capital stock		1,000,000.00
Profit and loss due to abnormal expense	2,234.34	
Sales		350,197.20
Cost of sales	229,171.30	
	$1,989,704.37	$1,989,704.37

FIG. 92. TRIAL BALANCE SHEET

This monthly checking up is done by means of two statements, the statement of condition and the statement of operations. The statement of condition is a form in which the assets and liabilities of the enterprise are listed, usually in parallel columns, in that way disclosing the net worth of the business. Since both sides of the account balance, the statement is often referred to as a balance sheet. To my mind, "statement of condition" more accurately discloses the purpose which is to answer the question, "Where do I stand?" The statement of operations in its turn answers the question "How did I make my profit or my loss?"

The statement of condition is in common use, but it discloses the net result of the operations for the period in bulk only. It is superior, but only to a degree, to the method still used by some quite successful business men, who every so often attempt to collect all the money due them, pay all their bills and consider that their bank balance plus their stock of goods on hand is their capital and the amount of that capital in excess of the capital of some other date is the profit made in the interval which has elapsed. The statement of condition gives no inkling as to where or why profits were made or failed to be made. The statement of operations, however, dissects the profit for the period and indicates where policies could profitably be changed.

The statements shown in this article are comparative, as you can see. A single figure standing alone means little. Considered in connection with a previous figure, it achieves a real meaning. It is only in comparing the figures with preceding periods and perhaps with the same period of another year that accurate deductions as to the operation of the business can be made.

Let us first consider how we arrive at the statement of condition. The first step is to take the trial balance of the ledger after all of the journal entries mentioned in preceding articles have been made. This trial balance which is shown in Fig. 92, is

not particularly significant because of the illogical arrangement of the items which comes from following the order of the ledger accounts.

Accountants, bankers and credit men have given much study to the form which the statement of condition shall take. The one shown in Fig. 93 is generally accepted as being the clearest and most logical arrangement. We therefore rearrange the trial balance figures in this form.

In order to get the comparison which is of such great value, we show on the single sheet the statement of condition for the current month and for the preceding month.

Before discussing the statement of condition further I want to forestall comments by accountants who may make the startling discovery that the figures shown are ridiculous for any business. For example, they might point out that this concern did not collect during January any of the accounts receivable which were on the books Dec. 31—admittedly not likely even in a business depression.

There are several other figures which to the accountant indicate that the business is poorly run—almost a comic opera business in fact. There are also many items of assets and liabilities which might appear but do not, because they would merely add complications without increasing the value of the discussion. The answer is that no attempt has been made in any of these articles to give figures which reflect the actual transactions of a real business. The aim has been, not to record all of the possible accounting entries, but to give only enough to show the business man *how* figures can help him. No ordinary textbook would be large enough to show all of the entries that might arise.

Therefore I have kept the figures and transactions as simple as possible, and have been content to show clearly, I hope, how the activities of the shop are reflected in the books. I have carefully traced items from account to account; but have not tried to make the size of the entries consistent with those in any real business. I am trying to make cost accounting clear to machine shop executives. I am writing for business men, not for accountants.

Returning to the statement of conditions; you see that in the comparison of the January 31 figures with those of December 31, the increases or decreases in each item of assets and liabilities can be easily determined. The total net increase or decrease in assets and liabilities is in the surplus account on the balance sheet. This increase of surplus, $116,893.11, which is the month's profit, is the balancing figure. It is arrived at also by means of the statement of operation and thus serves as a check on accuracy. It is shown on the statement of operations as "Net profit from operations" for the month ended January 31.

The statement of operations as shown in Fig. 94 is built up for the period to date, which in the case of our

STATEMENT OF CONDITION

Assets	December 31, 1920			January 31, 1921			Increases	Decreases
Current Assets and Inventories:								
Current Assets:								
Cash	$95,127.30			$79,204.71				$15,922.59
Accounts receivable	275,129.30			625,326.50			$350,197.20	
Total Current Assets		$370,256.60			$704,531.21		$334,274.61	
Inventories:								
Iron and steel	$35,197.60			$25,137.47				$10,060.13
Bar stock	40,191.65			27,341.13				12,850.52
Forgings and castings	75,128.50			54,274.62				20,853.88
Hardening and carbonizing materials	3,502.21			4,300.56			$798.35	
Materials purchased finished	25,189.20			25,232.02			42.82	
Lumber packing materials	625.30			923.80			298.50	
General stores	7,250.90			6,126.30				1,124.60
Fuel	5,003.90			5,371.29			367.39	
Goods finished and in process	187,925.50			26,520.33				161,405.17
Total Inventories		380,014.76			175,227.52			$204,787.24
Total Current Assets and Inventories			$750,271.36			$879,758.73	$129,487.37	
Fixed Assets:								
Real Estate	$50,000.00			$50,000.00				
Buildings	452,391.67			452,629.11			$237.44	
Machinery	370,431.99			372,624.64			2,192.65	
Total Fixed Assets		$872,823.66			$875,253.75		$2,430.09	
Less Reserves for Depreciation:								
Buildings				$1,319.47			$1,319.47	
Machinery				3,711.17			3,711.17	
Total Reserves					5,030.64		$5,030.64	
Net Value of Fixed Assets			872,823.66			870,223.11		$2,600.55
Deferred Charges to Operations:								
Prepaid building insurance						1,387.80	$1,387.80	
Total Assets			$1,623,095.02			$1,751,369.64	$128,274.62	

Liabilities and Capital:	December 31, 1920			January 31, 1921			Increases	Decreases
Liabilities:								
Accounts payable		$297,128.50			$308,214.18		$11,085.68	
Notes payable								
Sundry liabilities							112.50	
Insurance accrued					112.50			
Taxes accrued					183.33		183.33	
Total Liabilities			$297,128.50			$308,510.01	$11,381.51	
Capital:								
Capital stock—Outstanding		$1,000,000.00			$1,000,000.00			
Surplus (see Statement of Operations)		325,966.52			442,859.63		$116,893.11	
Reserve for Federal income and Excess Profits Taxes								
Total Capital			1,325,966.52			1,442,859.63	$116,893.11	
Total Liabilities and Capital			$1,623,095.02			$1,751,369.64	$128,274.62	

FIG. 93. STATEMENT OF CONDITION

STATEMENT OF OPERATIONS

		For Month Ended January 31, 1921
Sales		$350,197.20
Less returns		
Allowances		
Net sales		$350,197.20
Cost of goods sold		229,171.30
Manufacturing profit		$121,025.90
Less adjustments through abnormals:		
Abnormal manufacturing expense	$2,242.70	
Ceredit abnormal tool room	8.36	$2,234.34
Net manufacturing profit		$118,791.56
Less selling expense		1,898.45
Trading profit—net income from operations		116,893.11
Other income:		
Cash discounts taken		
Interest received		
Miscellaneous		
Total other income		
Total income		$116,893.11
Deductions from income:		
Cash discounts given		
Interest paid		
Miscellaneous		
Total deductions from income		
Net profit from operations		$116,893.11
Unallowable Deductions:		
Reserve for Federal income and excess profits taxes		
Balance, transferred to surplus		$116,893.11
Surplus beginning of the period	$325,966.52	
Deduct dividends paid		
Adjusted surplus		$325,966.52
Surplus at end of period (See Statement of Condition)		$442,859.63

FIG. 94. STATEMENT OF OPERATIONS

hypothetical business is for the month of January which is the first month of the period. In Fig. 95 a supposititious statement as of February 28 is shown. On this the operations for the full period to February 28 are shown, together with the statement for the period ending the preceding month—January 31. The difference between the two sets of figures gives the operating results for the latest month—February.

The final result of correct additions and subtractions will be the profit and loss, first by totals (two, three or four months and so on) and secondly for the current month. It is in this way that the operating statement develops the profit and loss independently of the statement of condition. The figure thus arrived at, added to the amount of surplus at the beginning of the month or period, less any current month's surplus adjustments gives the final surplus which is the balancing or proof figure on the balance sheet.

Thus we have made doubly sure that a profit has been made. But we have not yet learned how and why it was made. Perhaps we lost money on more than half of our lines of product and made a disproportionate profit on the rest. To get a close view of our business adventure we must put each item under the microscope. This we do by analyzing the statement of operations to show the result of our operations in each product. In Fig. 96 we show a statement of operations analyzed by lines of product.

You will note that the first column shows the gross figures for the business as a whole. These are in turn subdivided and carried towards the right-hand side of the sheet by classification of product. The total of the sales by lines must check with the total credit for the month that has been posted to the sales account on the ledger. Underneath the gross sales appears the item "Less Returns and Allowances." For simplicity we are not showing any figures for this deduction for the current month. After making this deduction the result is the net sales for the month or period. Many manufacturers prefer to keep accounts for their many subdivisions, but it is not essential. A subsidiary record can be maintained which will give this information at all times. The best accounting practice of today is to eliminate all details from the general ledger. The general ledger is a controlling ledger and the supporting details are supposed to be carried in subsidiary records.

On the complete operating statement shown in Fig. 95 is an item "Cost of Goods Sold," $229,171.30, which is built up on the detailed statement Fig. 96. One way to do this would be to take an inventory of all materials at the beginning of the period and add all purchases of labor, material and expense and at the end of the period deduct the inventory of all materials on hand. The difference would be the consumption or cost of goods sold. This, however, would require taking an inventory at the beginning and end of the period, which would be out of the question for most concerns. To avoid this laborious and costly detail, we work on the consumption basis, taking into consideration the cost of labor, material and expense which has been expended on the goods actually sold and shipped. This is the reason for developing the "goods finished and in process" account with which we have already had to do. This intermediary account is charged with all labor, material and expense consumed in processing and is credited with the final cost of the goods sold and shipped. Therefore, we build up the cost of sales in exactly this manner, starting first with the amount in the "goods finished and in process" account at the beginning of the month.

The next step is to show in detail the various additions that have been made to the goods finished and in process account. First we add the amounts of each kind of material that has been withdrawn from the raw material inventories and charged to the goods finished and in process account during the month. Next is added the productive labor and then the expense. In the various preceding chapters you have been shown how these have one by one been accumulated. Therefore this statement is not new work—it is merely a compendium of ready figures. In addition to these we also show any abnormal expense that was added to the goods finished and in process, as has already been explained in the article on abnormal expense. The total of all of these consumptive figures is added to the inventory of goods finished and in process at the beginning of the month.

If from the goods in process any partly finished work has been taken or if any items for asset accounts (for example, special machines built in the factory for your own manufacturing purposes) has been taken, these deductions are listed here and are deducted from the total inventories and additions. From this balance we deduct the amount shown in the "goods finished and in process" account at the end of the month. The resulting difference represents the cost of goods sold and shipped.

This cost of sales or goods sold is analyzed by product

STATEMENT OF OPERATIONS

	For Month Ended January 31, 1921		For Two Months Ended February 28, 1921		For Month Ended February 28, 1921	
Sales		$350,197.20		$564,372.89		$214,175.69
Less returns			$4,123.56		$4,123.56	
Allowances			347.50	4,471.06	347.50	4,471.06
Net Sales		$350,197.20		$559,901.83		$209,704.73
Cost of Goods Sold		229,171.30		403,979.87		174,808.57
Manufacturing Profit		$121,025.90		$155,921.96		$34,896.06
Less Adjustments through Abnormals:						
Abnormal manufacturing expense	$2,242.70		$4,157.36		$1,914.66	
Credit abnormal tool room	8.36	2,234.34	8.36	4,149.00		1,914.66
Net Manufacturing Profit		$118,791.56		$151,772.06		$32,980.50
Less Selling Expense		1,898.45		7,485.23		5,586.78
Trading Profit—Net Income from Operations		$116,893.11		$144,286.83		$27,393.72
Other Income:						
Cash discounts taken			$3,451.22		$3,451.22	
Interest received			10.50		10.50	
Miscellaneous			5.00		5.00	
Total other income				3,466.72		3,466.72
Total income		$116,893.11		$147,753.55		$30,860.44
Deductions from Income:						
Cash discounts given			$11,187.29		$11,187.29	
Interest paid			125.40		125.40	
Miscellaneous			3.95		3.95	
Total Deductions from Income				11,316.64		11,316.64
Net Profit from Operations		$116,893.11		$136,436.91		$19,543.80
Unallowable Deductions:						
Reserve for Federal Income and Excess Profits Taxes				22,447.98		22,447.98
Balance Transferred to Surplus		$116,893.11		$113,988.93		*$2,904.18
Surplus Beginning of the Period	$325,966.52		$325,966.52		$442,859.63	
Deduct dividends paid			15,000.00		15,000.00	
Adjusted Surplus		325,966.52		310,966.52		427,859.63
Surplus at End of Period (see Statement of Condition)		$442,859.63		$424,955.45		$424,955.45

* Debit balance.

FIG. 95. COMPARATIVE STATEMENT OF OPERATIONS

in exactly the same way as were the sales. The difference between the cost of goods sold and the net sales gives the normal manufacturing profit. This normal manufacturing must be corrected by adding any profit or subtracting any loss due to abnormal expense, to arrive at the net manufacturing profit for the month.

Having on the detailed statement of operations, Fig. 96, determined the manufacturing profit we turn back to Fig. 94.

From the net manufacturing profit we deduct the selling expense for the month, which gives the trading profit. For the month ending January 31 this is $116,-893.11. Sometimes it is well to normalize the selling expense in which event we would deduct from this figure the abnormal selling expense, thus arriving at the final trading profit, or to use the accounting expression the "net income from operations."

This is the profit from manufacturing and selling a product. But very likely the business has other activities which affect the profits and should be separated from the factory operations. For example, such items as interest paid or received, and cash discounts taken or allowed have no relation to manufacturing but result from the maneuvering of capital. If you pay interest it is for the use of more capital than you own, and it cannot justly be charged to manufacturing. When you receive interest, it is because you have excess capital and the income does not reflect manufacturing skill. You allow a cash discount for the prompt return of capital which has gone out of your business in the form of finished goods. These capital charges or credits are added to or subtracted from your trading profit, thereby arriving at a final net profit from all operations.

I do not describe these financial statements in the hope of making accountants out of business men. But I have tried to describe them in such a way that business men will see just how it is that properly assembled statements actually do picture the conditions and operation of the business. Based as these statements are, both upon the general books of account and upon the cost system, they tie together and give close control of the business. In the ordinary machine shop it should be possible to lay these reports upon the executive's desk within three or four days after the close of each month; certainly in no case later than the 8th or 9th—even in plants with a thousand people on the payroll.

DETAILED STATEMENT OF MANUFACTURING OPERATIONS*

		Totals	Grinders	Lathes	Shapers	Milling Machines	Boring Mills
Sales		$350,197.20	$101,011.50	$23,487.20	$26,709.00	$108,000.00	$90,989.50
Less returns and allowances							
Net sales	'$350,197.20	$350,197.20	$101,011.50	$23,487.20	$26,709.00	$108,000.00	$90,989.50
Cost of Goods Sold:							
Inventory of goods finished and in process, beginning of period	$187,925.50						
Additions to Inventory:							
Productive labor	10,615.06	(Detailed figures showing proportions of each of items in first column, are shown here if the executive wishes.)					
Castings and forgings	21,781.38						
Bar stock	13,613.85						
Iron and steel	9,885.03						
Lumber and packing material	2.50						
Materials purchased finished	1,348.18						
General stores	134.86						
Manufacturing expense	10,678.07						
Miscellaneous	157.20						
Total inventory and additions	256,141.63						
Less transfer to selling expense	450.00						
Balance	255,691.63						
Less inventory of goods finished and in process end of period	26,520.33						
Cost of goods sold		$229,171.30	$68,759.00	$26,495.50	$14,925.80	$68,451.00	$50,540.00
Manufacturing profit		$121,025.90	$32,252.50	*$3,008.30	$11,773.20	$39,549.00	$40,449.50

* Loss. Not including "abnormal" charges, which, as shown on Fig. 3, are later deducted.

FIG. 96. STATEMENT OF OPERATIONS ANALYZED BY LINE OF PRODUCT

Facilities at the Puget Sound Navy Yard

Large Gantry Cranes—The Working of a Six-Ton Electric Steel Furnace—Progressive Views of Marine Engine Erection

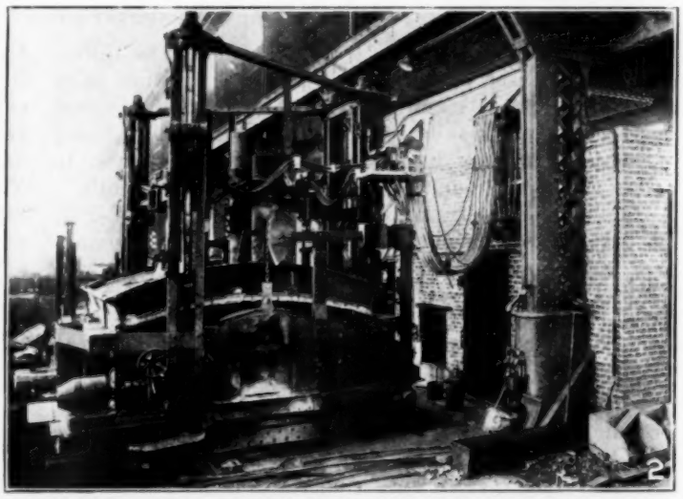
By FRED H. COLVIN
Editor, *American Machinist*

SOME notion of the general facilities at the Puget Sound Navy Yard can be had from the accompanying illustrations. The two large gantry cranes shown in Fig. 1 are particularly valuable in handling material from the yard to the ships or vice versa. In this case, they are hoisting one of the four Babcock & Wilcox boilers on board Ammunition Ship No. 2. The weight of one of these boilers, together with the lifting gear, is 61,320 lb. The cranes were built by the McMyler-Interstate Co., of Cleveland, Ohio, and as can be seen, have a considerable range and capacity.

Part of the foundry equipment is shown in Figs. 2 and 3. These views show a 6-ton electric steel furnace installed by the Electrical Furnace Construction Co., Philadelphia, Pa., and which has been giving excellent satisfaction. Fig. 3 is a closer view of the furnace from the pouring side and shows how the gate is controlled. It also gives a better idea of the large carbons used and shows some of the mechanism by which the furnace is tilted for pouring.

The electric furnace was installed about two years ago at an approximate cost of $60,000. It was a difficult task to find suitable space for a furnace of this size in a foundry already built, it being essential that the furnace should be so located as to have all necessary crane facilities. The floor space needed is 60 x 60 ft. The furnace proper is located nearly in the center of this space and is 12 x 12 ft.

The electric current used is 2,300 volts at the transformers and is reduced there to three different voltages, 100 volts on two carbons for melting, 85 volts on two carbons for refining and two other connections at 60 volts each for holding the heat. It requires about one hour to charge the furnace and four and one-half hours to conduct a heat. The furnace uses 900 kw. per ton of melt. Much better results can be obtained when the furnace is used continually and not allowed to cool before recharging. The carbons are raised when the furnace is charged. The carbons are 14 in. in diameter, 6 ft. long and weigh 550 lb. each. The carbons are water cooled on top of furnace in order that the link chain



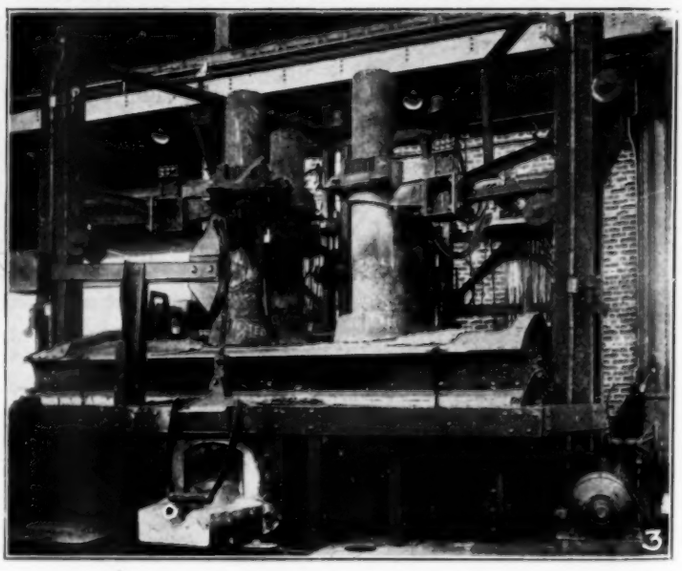


FIG. 1. GANTRY CRANES HANDLING BOILER. FIG. 2. SIDE VIEW OF THE 6-TON ELECTRIC FURNACE. FIG. 3. THE POURING SIDE OF THE FURNACE

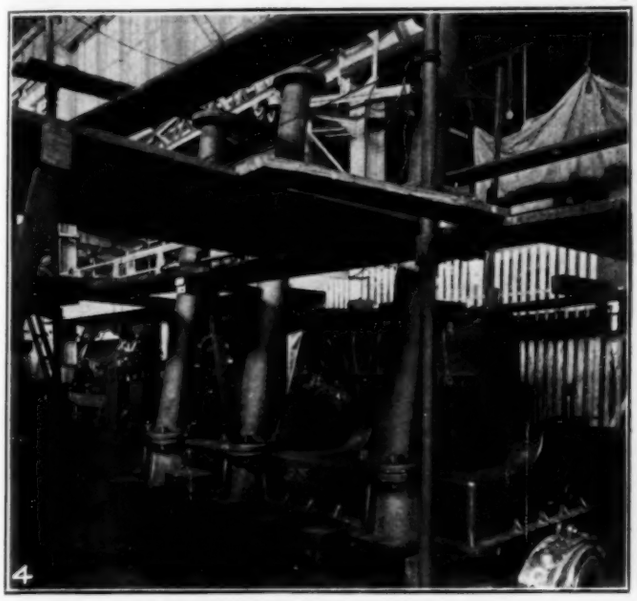
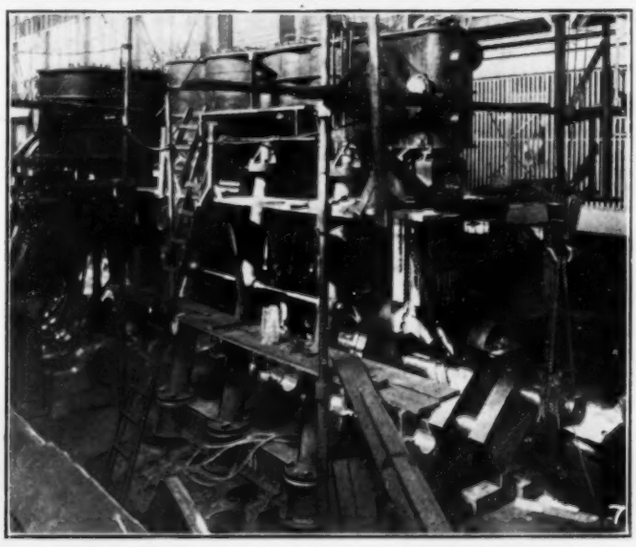
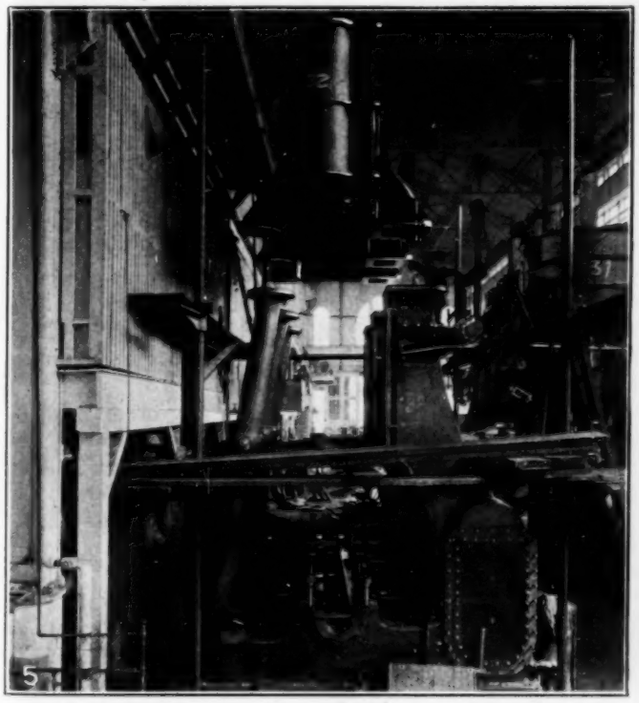


FIG. 4. BEGINNING THE ERECTION OF A TUG ENGINE

can hold them securely. They are automatically lowered when the furnace is in operation, and about 30 lb. of each carbon is used to run a heat. The furnace must be relined after about 170 heats, or when the top shows the first signs of burning through. It requires three men to operate this furnace.

Figs. 4 to 8 inclusive are an interesting series of progress views of the erection of a sea-going tug engine. Fig. 4 shows the front columns and one section of the condenser in place. Fig. 5 is an end view, showing both the front and rear columns erected and the remainder of the condenser in place.





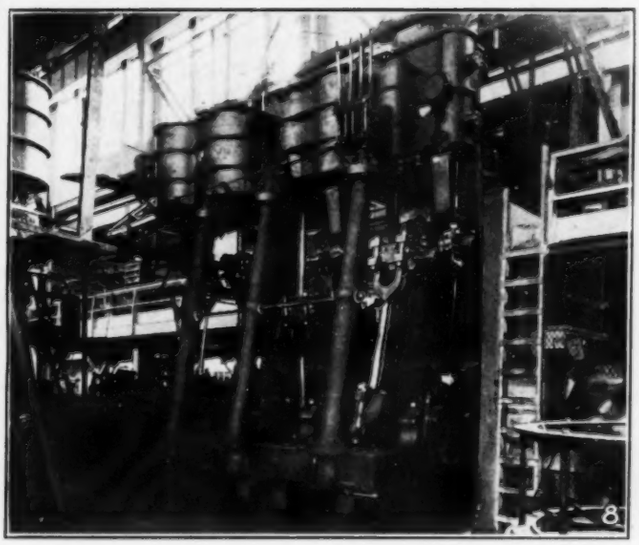


FIG. 5. LOWERING THE CYLINDERS INTO PLACE. FIG. 6. READY FOR THE CRANKSHAFT. FIG. 7. PUTTING THE CRANKSHAFT INTO POSITION. FIG. 8. THE COMPLETED ENGINE

In Fig. 6 the engine begins to assume complete proportions and is all ready for the installation of the crankshaft. This is being swung into place in Fig. 7 which shows the arrangement of slings and hoists at *A*, *B* and *C*. Fig. 8 shows one of the completed engines ready for installation in the hull of the tug.

Organization and Management of the Small Shop

II—How to Analyze Manufacturing and Marketing Problems—A Common-Sense Questionnaire Concerning the Product—Necessity of Definite Information and Objectives

By ELMER W. LEACH

THOUSANDS of men who saw service in the recent war will recall the many interesting hours they spent "playing war" with relief maps for their scene of operations and toy soldiers for their commands. After a long hike with a heavy pack under a hot sun, or after a tiresome morning on the rifle range it was always a welcome order to report for a lesson with the maps and toy soldiers.

With these maps spread out on the floor and regiments of these tin soldiers to move about as desired, whole campaigns were planned and worked out to the smallest detail. The scene of operations was carefully analyzed, the position of the enemy, his probable course of action under the attack, the cost of the operation in money and in casualities, the time when it should take place, the time it would require, the results gained, all those phases of the problem and many more were reduced to an exact science.

Charts, maps, diagrams, drawings, reports, cards, records of all sorts were used in greater proportionate volume than they are employed in most businesses. And was it all worth while? Did it help to bring about the desired victory?

It is not necessary to print the answer to those questions. And yet how many business men there are, and how many men planning on entering business, who can see no parallel in their own personal problems.

When a man received his baptism of fire, he thanked himself religiously for those months of training and study he had been privileged to spend. Not that he would have been afraid to face the fight without that training if need be—but with a praper of thanks for the good old Uncle Sam who had been willing to give him all that training, so that he might go into the fighting with a clean, clear vision of the sort of struggle that waited ahead, and with a firm foundation upon which he might easily afford to wager the possibilities of victory.

Business is a war. I do not mean to suggest that it is that seething, destructive, bloody, hate-breeding tumult that war is to some of us; but I do mean that it is a struggle, a fight.

There are opposing forces in every field of business. There is always competition. Different groups are working for their own personal gain, with no special consideration for other conflicting groups. You must expect to meet resistance from certain quarters. You must count upon an increased activity in competitive spheres aimed plainly and unquestionably at yourself. Do not make the fatal mistake of presuming that because your product may actually be somewhat superior to any other similar product on the market your article will have a 100 per cent consumption and the sales of your competitors' articles will automatically drop to zero when your first piece of advertising makes its appearance. You can never have all of any field entirely to yourself.

Theodore Roosevelt, I believe, is credited with having given this very valuable bit of advice to the world: "Be sure you're right, then go ahead and stick to it." That expression contains the suggestion of the three important phases of your opening days in the business world; first, a careful investigation of the practicability and the possibilities of your idea; second, the courage to actually carry your idea through to a reality; and third, the perseverance and the patience to believe in your idea and in the ultimate sureness of success.

Eliminate the Guesswork

The day you enter business for yourself is far more important in its significance than the day you deposited your first dollar in a savings account. But I'll wager that when you did that you inquired whether the bank paid four or four and one quarter per cent interest, and whether it was compounded quarterly or not.

And yet are you thinking of entering business before you know what profit you will realize on your investment and whether your capital will turn over every quarter?

There is really no guesswork in business; at least no successful business man ever employs guesswork. My insurance company does not *guess* that they should charge me $21.20 a year for $1,000 worth of insurance, nor do they *guess* that they should add $1.80 to the premium if I wish the privilege of arranging for my beneficiary to receive double the amount of protection should I be killed by accident.

Those figures have been arrived at most scientifically. They *know* that in the average that is the correct amount to charge. They do not know that I will die by accident. But they do know from investigating statistics over a long period of years that a certain number of men at certain ages are killed each year by accident. They know what percentage of men in different occupations are killed by accident. And so they know the *likelihood* of my suffering that unfortunate experience.

The insurance business, more than any other field, is one in which the problems have been thoroughly analyzed and the guesswork been reduced to facts. And yet this is the most difficult field of all in which to do that thing, for the only materials with which they have to work are human lives, things entirely beyond our own control.

Your manufacturing problems, dealing as they do with iron and steel and material things, can be studied much more definitely and with much greater assurance of correct conclusions.

Therefore, in considering the possibilities of the success of your business venture, correct information is your most essential requirement. Until your decisions are based on certain conditions of fact, they are sheer guesswork and you are risking your money and prestige and the possibility of success.

You are entering into a distinctly new portion of your active life when you establish yourself at the head of your own business. If your idea is at all pretentious, it holds promise of developing an organization in which you will spend your entire business life. The success which you realize and the progress which you make during your first two years in business have tremendous significance in determining your wealth and your standing when you are fifty.

Analyze the Problems of Your Business World

Do not then, no matter how sincere the confidence in the certainty of your own suppositions, cast your fortunes into the world of business without a most thorough analysis of the problems about which the world of your business revolves.

The Champion Spark Plug Co. is an excellent example of a successful organization that can well serve as an inspiration to any new manufacturer. Yet I know of a gentleman who conceived the idea of a spark plug which had a small copper ring giving contact at 360 points about the circle, the theory being that the intensity of the spark obtained in this way would make his spark plug superior to any on the market.

He obtained a patent, had a large stock of spark plugs made up, printed stationery, and believed he was ready to figure his profits. However, when the spark plugs were put to the test of actual use it was found that the all-important ring expanded under the heat and dropped out of place, so that the acticle was absolutely worthless.

One would presume that this man would have investigated his product before going to such expense, and yet he is only one individual of thousands. In some instances the business is actually established and operating presumably at a profit before the impracticability of the product is brought to the surface.

Place your product on some stand where you can study it thoroughly. Be sure that no one else is near to prevent you from being absolutely frank and truthful with yourself. Consider its every quality and feature from every possible angle and viewpoint, and then ask yourself if it is really practical.

Does it actually do the work or perform the operation for which it is designed? This is something you cannot determine on paper. You must have a small quantity of your machines or goods made up, try them yourself, test them under all sorts of conditions and in as varied uses as they will be put to by actual purchasers. Possibly, if the nature of your product permits, and if the expense is not too great, you can actually place your machines on approval in the shops or places where they will be used.

Let them undergo the test of actual operation. Learn the opinions of those who have tried them. Collect all possible data about the performance of your product, so that when you are ready to market it you can give facts in your advertising found through actual experience.

Does it do that work cheaper, better, in less time, with less labor, or by using less material than if the work were done by hand? Some companies will claim all those qualities for their product, but usually such claims must be qualified considerably. It is quite unlikely that your product has *all* the possible good features. There will be some particular element in its construction or some special feature of its operation that will be distinctive of your goods. Study the performance of your product, find what that point is, and make it the basis of your appeal for business.

Will your product wear out quickly? This is another phase of the practicability of your product which you can only determine by experiments extending over a long period of time. A high-speed steel drill costs more than twice as much as a carbon drill. If it only lasted half as long as a carbon drill there would be no justification for its use.

Does your product fit into present common practice? Your machine may be impractical because some feature (maybe a point of superiority) or some detail of design makes it necessary to use that machine in a different way than such machines are ordinarily used. In a certain instance it was necessary to change the construction of a machine, because the cost of educating the operators into the proper use of the more difficultly operated article would have been disproportionate to the price of the machine itself.

Does it have an appearance that fits into the place it will occupy? Children like a Christmas tree because of the appearance, and grown people are often swayed by that same thing. Some men will buy an automobile because of the lines of the body without inquiring about the make of the engine or the mileage per gallon of gasoline. Often a product that would not appeal if coated in black enamel will sell readily if it is painted in a light blue and the name of its maker shown on a neat brass plate. A garbage incinerator for the basement of your home can look quite different from one you would want to place in your kitchen. Your product can be impractical from lack of attractive appearance.

What are its defects? Your product is not perfect, of course. In some place it falls down—everything does. Your competitors will pretend to have discovered any number of disadvantages of your goods over theirs. But you should discover those disadvantages first, if they really do exist. If the defects interfere with the operation of the machine, they must be corrected before your finished product is offered to the trade.

Can it be easily adapted to other uses which will increase its demand? I shall take the liberty of drawing an illustration from equipment for shoe repair shops, for that is the field with which I happen to be particularly familiar.

"Skive" means bevel; consequently in a shoe shop a "skiver" is a machine that cuts a bevel on a piece of leather. One shoe machinery company had a skiver in its line of equipment. It had sold thousands of them when one day someone inquired whether the machine would cut a bevel on the fabric of an automobile tire casing.

That inquiry started an investigation which opened up a new field with greater possibilities than their first market; and from the vision which that first suggestion created has now come a complete line of equipment for tire repair shops, from the large five-section vulcanizer to the small hand tools.

Study the varied uses for your product. You may find some adaptation to a new use which had not occurred to you at first that will have a very material effect in fixing your marketing problems.

Will its price be consistent with its performance? I believe that a machine could be devised to lace a person's shoes; but such a machine would surely cost several hundreds of dollars, and I should not care to pay that much just for the privilege of having that task performed automatically.

In designing your product, if it be a machine to replace a former hand operation or to assist a hand

operation, it must be confined to a price at which it will eventually pay for itself and prove to be an investment instead of an expense. You must put it out at a figure that will make its installation and its use justify its cost.

If you can prove to your prospects that your machine pays for itself, then it becomes a near necessity no matter what its price may be.

The Result of Your Analysis

The questions I have listed here are suggestive questions which you can ask yourself about your product. If it does not meet your expectations in one or two particulars you need not be discouraged. If it appears vastly superior in some respects do not feel over-confident. For your purchasers will see your product from all viewpoints; they will single out its distinctive features as well as its shortcomings; and upon the average which those good and bad points make—the impression they form of your product as a whole—will depend their demand for your goods.

After you have placed your final O.K. upon the design of your product so that it will be commercially salable, you will probably be required to go over it again, part by part, and make a number of changes to adapt it to quantity production. The moment that your plans for manufacturing your product begin to assume definite shape you will have to concern yourself with the cost of production, for it is upon that figure that your selling price and your profit will depend.

If you intend to equip a shop and do your own manufacturing, you must let your design be determined largely by the amount of capital which you can obtain for your shop equipment. It is hardly likely that you will want to make every part yourself; and so you will want to go over your product carefully and decide what parts of it can best be made by outside companies.

The materials of which your machines are made will have an important bearing upon the extent to which you will want, at first, to call upon outside concerns for work. If you are getting out some small machine on which one or two of the parts require heat-treating, it is improbable that it will be worth the expense to install your own heat-treating equipment. For the first few months when you will want to confine all expenditures for equipment to as low a figure as possible, it will be better for you to turn this class of work over to outside jobbing shops.

And even after your production is up to the point where you prefer to do the heat-treating within your own shop you will find, if you are at all resourceful, that a large part of the necessary equipment can be made by yourself.

It is obvious that if there are but one or two milling or planing operations on all your parts, you could not afford to purchase a miller or a planer when you first equip your shop.

It is surprising what different kinds of work can be done on an ordinary engine lathe when necessary. In our own little business there were a few of our first machines in use that had been made before we organized as a definite manufacturing concern with our own plant. All of the parts of those machines had been made on a small South Bend lathe and a bench drill press.

By putting a cutter on a mandrel between centers and fastening the casting to the compound rest, the necessary surfaces were milled as satisfactorily as though we had used a $2,000 universal milling machine. Gears were cut by holding the cutter between centers, fixing the gear blank in a simple device fastened to the rest, and bringing the work past the cutter by the cross feed.

Such methods, of course, meant that production was very limited; but it is much better that your income be small because of restricted installation of equipment than that your expenditures be unreasonably large because of purchases of machine tools which you cannot at first keep busy up to more than a small part of their capacity.

The Importance of Conservation

What is worth doing at all is worth doing well; and that applies to the purchase of shop equipment as strongly as to anything else. Be very cautious about installing second-hand machine tools. Remember that someone else felt he had gotten full value out of that milling machine before he offered it for sale to you.

You cannot afford to be extravagant during these early days, and there are any number of tools which would be very desirable and which would surely have a tremendous effect in lowering your costs. But you simply cannot afford some of them, rather, you cannot afford to tie up capital in equipment which could be used so conveniently in furthering the progress of your company through use in other ways.

There are other problems besides purchasing of equipment which will call for careful consideration, such as the advisability of renting or building. One of the good arguments against renting a small building is that shortly after you are well established on a profitable basis you will be obliged to tear up your shop, delay production for a while, and move into a larger location. Moving is an expensive procedure and it always delays continuous operations. However, unless you plan to have more than $25,000 original working capital, I believe you will be ahead financially by renting a building for at least the first year.

Just very roughly, it is possible that you can rent for $50 a month the same space that would cost you $5,000 to duplicate. Rent is an expense, and in a certain sense you have nothing to show for it after it is paid; so that you may question the wisdom of spending $600 in that way during your first year. But by doing that instead of putting up a $5,000 building of your own, you will have $4,400 to use in other ways which will be much more productive during your first twelve months of operation than if you were to put it into your own plant.

Put that extra money into merchandise, or put it into advertising and sales promotion if you choose, and when the time comes that you are pressed for larger quarters, you will be in a good sound position to think about a factory building of your own.

The same sensible viewpoint must be taken in considering expenses for jigs and fixtures. Box tools, automatic die heads, tapping attachments, and special jigs are all conducive to lower production costs; but right now, while you may be working for someone else in some large plant that is a model for efficient equipment, you must remember that your employers have probably been able to have that equipment because of early economies.

A small shop operating at a profit is much better than a large shop operating at a loss. The cost of "getting started" is something which you can predetermine very definitely; but the cost of "keeping going" is a figure

on which the most experienced analyst would not venture an estimate.

So many beginners in business estimate, for example, that $5,000 will equip their shop, purchase merchandise, meet the payroll for three months, and put them in a position where their shipments will be $1,000 a month. As a consequence, they believe they have made unfailing plans to be on a profitable working basis in three months.

Even though you may believe that you can arrange such a schedule for your own business, do not plan to have used all your original capital by the time you had *planned* you would be operating at a profit. Cut your equipment appropriation in two, cut your other items down considerably, and retain a good reserve for operating expenses which you were not able to foresee. There will be a surprising number of expenditures to be classified under that heading.

We must all crawl before we can walk. It is no disgrace to start small. The companies which begin in a small way and experience a trying struggle for existence and progress are given a conception of real business problems and an understanding of the serious effort that overcomes obstacles which they can consider one of their very valuable assets and which cannot help but reflect itself in later successes.

Co-operation—What Is It?

By Entropy

It is said of James J. Hill that at a director's meeting of one of his numerous interests that all hands were at loggerheads and apparently could not get together. He called on them to co-operate. One of the directors asked him just what he meant by that, to which he replied, with a blow of his fist on the table for emphasis, "Do as I tell you, and do it d—— quick."

This story could probably be told with equal regard for the truth of many great figures in finance and industry. It is characteristic of many of them. The principal difference is in the expletive, and the degree to which the big stick is allowed to repose out of sight back of the door or whether it is swung in sight of the crowd. In either case it seems to be certain that the best co-operation is found where there is a dominant leader rather than where there is an equality of minds, in which case the co-operation is really the result of all hands following, with more or less reason, the one man and not the result of any marked attempt to co-operate with each other.

It is really a serious question whether such a thing as real co-operation is the practical way in which to do business. We all expect an umpire to settle differences of opinion, and most of us are good enough sports so that we accept his decision with very little grumbling and go at the game again with a will, even though in his fairness he does not give *us* all the decisions. More than that we are, almost all of us, looking for leadership. Not more than one man in a hundred will take command unless he is forced to do so. We may aspire to it, but we are afraid of our own abilities, or else we are so afraid of criticism that we do not dare risk it. A great many of the minor executives in industry, and some that are much higher, are coinciders rather than executives. They transmit leadership, dulled and modest, rather than assume it. They may bluster and show their teeth when they feel that it is safe, but it has to be very safe before they take any initiative.

Human nature does not appear to have undergone any great change for the few thousand years of which we have positive information. If any change has taken place, it appears to be that executives have tended more of late than they did in the time of Julius Caesar to take counsel and advice from others as well as their personal friends. It is really too much to expect that in matters of any great importance people of similar degrees of intelligence will look at the same set of circumstances in the same light. This is notably shown in the psychological tests for association, where the moment the obvious tests like associating snow with winter, fire with warmth and so on are passed, the increase in the variety of associated ideasis in direct ratio to the intelligence of the persons under examination. It is further noticeable in any organization of business men where we find great differences of opinion regarding the simplest matters. This is very plainly shown in the columns of popular reviews of the world's events, where the views of editors the world over show such complete difference of interpretation that it seems hopeless to expect the world to agree on anything whatever beyond the simplest things that are reducible to mathematics, and even Einstein comes along to upset, or try to, all our preconceived notions as to the result of adding two and two.

Knowing then as we do that no two people in any organization of live men are going to see all things in the same light, it appears to be necessary for an agreement to be reached by compromise. Compromise is seldom reached except by leadership. Some one man, knowing in advance the arguments which will be used on both sides, lays out a practical path, which combines as many of the good things on both sides as he thinks it possible to agree on, and proceeds to let the opposing parties exhaust themselves in overcoming each other. When the psychological point is reached, he proposes one after another of his compromises and secures the passage of many of them simply because the opponents are tired out and they welcome a fresh point of view.

When we are considering the co-operation of employees with the management, we only have the same conditions extended to a larger number of people. The man who can handle a small number of directors around a table is not by any means the one who can handle a large meeting and carry his leadership into the larger number with the same effectiveness. Of all the presidents of the United States there have been but few who caught the popular acclaim, who could appeal to the country and yet who were equally happy with a strong cabinet. Lincoln and Roosevlet stand out prominently in our minds as men who were believed in by the great number of voters and who did not suffer from a large labor turnover in their official families. And yet it is undoubtedly true that it is easier to lead large numbers of people of average intelligence than it is to carry a few men of real capacity for thought. The popular mind responds to frankness and to a clear exposition of aims. The moment the masses suspect that something is being kept back from them they are ready to vote against it. In a small board of directors everyone knows, or thinks he knows, the weaknesses of the other members and plays all his cards against those weaknesses. They all suspect the others of holding back something.

Tap Drill Sizes

Elements to Be Considered—What Constitutes the Government Standard—Minimum and Maximum Limits for Tap Holes—Determining the Ideal Drill Size

BY COL. E. C. PECK AND T. F. GITHENS
Cleveland Twist Drill Co.

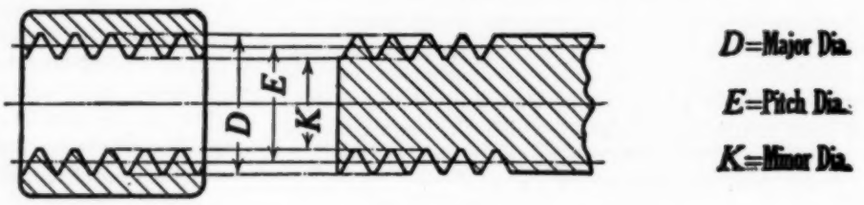
"WHAT size tap drill shall I use?" is the question asked in every shop. This cannot be answered definitely without knowing all the conditions. There never was a table published which satisfied half of the engineers. If the tap drill is too small, we have a large breakage of taps. If the tap drill is too large, we have tapped holes in thin material which do not have sufficient thread to hold anything. It is therefore perfectly obvious that a tapped hole in thick material should be drilled larger for the same tap than one in thin material. Different kinds of material require a different sized tap drill for the best results, due to a difference in the flow of the metal being tapped.

It is suggested that the best size tap drill to use is the one which will drill a hole of such size that after the thread is tapped, the minor diameter will be within the minimum and maximum limits as given in the "Progress Report" of the National Screw Thread Commission.

This report of the National Screw Thread system has been issued and has been approved by the secretaries of War, Navy, and Commerce, and is, therefore, at the present time a standard for all government work. (A copy of this report may be obtained by writing to the Bureau of Standards, Washington, D. C.) It is evident, then, that screw thread products for the government will be gaged according to the dimensions given in the National Screw Thread Commission's report. In this report are described four classes of fits, namely, loose, medium, close and wrench. For the first three classes of fits the minor diameter of the internal thread commonly known as core diameter or inside diameter of the nut is such that the maximum depth of thread is 83⅓ and the minimum depth of thread is 75 per cent. This means that the tolerance given for the holes produced by tap drills will be between 75 and 83⅓ per cent full thread depth. These dimen-

COARSE THREAD SERIES
TAP DRILL SIZES

THE NATIONAL THREAD SYSTEM FOR SCREWS, BOLTS AND NUTS, as recommended by the National Screw Thread Commission in report dated June 19, 1920



The essential thing required of a tap drill is that the holes it produces must be within the limits given in the table below under the heading "Nut Minor Diameter," which have been agreed on as standard by The National Screw Thread Commission. It is necessary that the drill maker must be allowed some manufacturing tolerance or variation in the diameter of the drill. Some allowance must also be made for the drill to wear smaller in diameter, but this is partially offset by the drill cutting oversize due to improper grinding of the cutting edges. Columns showing minimum and maximum diameter under heading "Tap Drills" are the limits of the diameter of drills which The Cleveland Twist Drill Company believes will produce satisfactory results under average conditions, and are based upon the above considerations. The limits given for the diameters of tap drills permit a small variation well within and near the central zone of the tolerance or variation permitted in the Nut Minor Diameter.

Size	No. Threads per Inch	Basic Pitch Diam. Inches	Nut Minor Diam.		TAP DRILLS		
			Min. Inches	Max. Inches	K1 Min. Inches	K2 Max. Inches	Equivalent Regular Size
No. 1	64	.0629	.0561	.0578	.0570	.0575	*
No. 2	56	.0744	.0667	.0686	.0677	.0682	*
No. 3	48	.0855	.0764	.0787	.0776	.0781	5/64 in.
No. 4	40	.0958	.0849	.0876	.0863	.0868	2.2 mm.
No. 5	40	.1088	.0979	.1006	.0993	.0998	No. 39
No. 6	32	.1177	.1042	.1076	.1059	.1064	2.7 mm.
No. 8	32	.1437	.1302	.1336	.1319	.1324	*
No. 10	24	.1629	.1449	.1494	.1472	.1478	3.75 mm.
No. 12	24	.1889	.1709	.1754	.1732	.1738	4.4 mm.
¼ Inch	20	.2175	.1959	.2013	.1986	.1992	No. 8
5/16 "	18	.2764	.2524	.2584	.2554	.2560	6.5 mm.
3/8 "	16	.3344	.3073	.3141	.3107	.3113	7.9 mm.
7/16 "	14	.3911	.3602	.3679	.3641	.3647	9.25 mm.
½ "	13	.4500	.4167	.4251	.4213	.4219	27/64 in.
9/16 "	12	.5084	.4723	.4813	.4768	.4776	*
5/8 "	11	.5660	.5266	.5364	.5315	.5323	13.5 mm.
¾ "	10	.6850	.6417	.6526	.6472	.6480	*
7/8 "	9	.8028	.7547	.7667	.7607	.7615	*
1 "	8	.9188	.8647	.8782	.8715	.8723	*
1⅛ Inches	7	1.0322	.9704	.9858	.9781	.9789	*
1¼ "	7	1.1572	1.0954	1.1108	1.1016	1.1024	28 mm.
1⅜ "	6	1.3917	1.3196	1.3376	1.3271	1.3281	1 11/64 in.
1¾ "	5	1.6201	1.5335	1.5551	1.5443	1.5453	*
2 "	4½	1.8557	1.7594	1.7835	1.7715	1.7725	45 mm.
2¼ "	4½	2.1057	2.009	2.03354	2.0215	2.0225	*
2½ "	4	2.3376	2.2294	2.2564	2.2431	2.2441	57 mm.
2¾ "	4	2.5876	2.4794	2.5064	2.4929	2.4939	*
3 "	4	2.8376	2.7294	2.7564	2.7429	2.7439	*

FIG. 1. TAP DRILL SIZES, COARSE THREAD SERIES

sions are intended for average work where the length of the hole to be tapped is between one-half and one and one-half diameters of the tap. The dimensions of the minor diameters of the nut, which are given in Figs. 1 and 2, are the minimum and maximum limits referred to in paragraph (2), within which the size of the tap drill hole must be after the thread is tapped.

In order to make this clear, the charts shown in Figs. 3 and 4 have been drawn so that the distance between the base line *B* and the plotted line *A* represents the number of thousandths of an inch tolerance as given for the minor diameter of the nut in the National Screw Thread system for the standard sizes of the thread. Line *A* itself represents the maximum minor diameter of the nut, 75 per cent of the thread depth. The base line *B* represents the minimum minor diameter of the nut, 83⅓ per cent of the thread depth.

The Ideal Tap Drill

It is required, therefore, that the tap drills should produce holes between these two lines. If a drill is selected too near the upper line, there is a danger that it may cut over-size due to imperfect grinding of the point and other conditions. If the drill is selected near the lower line it may wear undersize too rapidly, especially when drilling cast iron. It seems, therefore, that the ideal tap drill would be a size which was located midway between the two lines *A* and *B*, as it would then give the drill a chance to wear from its size to the base line or cut oversize from this line to the maximum size of the hole allowed.

These midway sizes are represented by line *K*1 on the charts and the values of *K*1 are given in Figs. 1 and 2. Twist drills must also have a manufacturing tolerance. The nominal size of the drill is its maximum limit, therefore by taking *K*1 as the minimum size of the drill and allowing a small tolerance value, we obtain the line *K*2 which represents the nominal size of the ideal tap drill. Tap drills within the zone *K*1-*K*2 represent the best size to use.

The chart also shows the position occupied by standard stock size drills and it will be noticed that those recommended in the Cleveland Twist Drill Co.'s list in Figs. 1 and 2 are close to or within the zone of the best size tap drill.

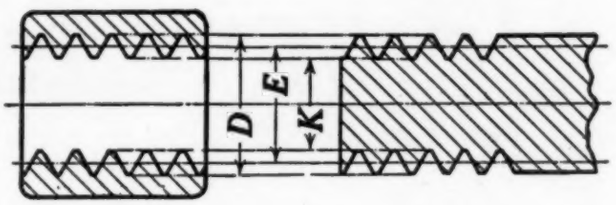
Where no standard drill is within this zone, as for example the ⅞ thread, fine thread series, it is suggested that a new standard size drill will pay for itself if carried in stock, this drill to have the dimension given in column *K*2 in the tables. This drill might be known as ⅞ x 18 N.F. tap drill (N.F. meaning National Fine Thread Series), other standard tap drill sizes being designated in a similar manner.

[Editor's Note.—Since this report was issued, the National Screw Thread Commission has outlined a program for con-

FINE THREAD SERIES

TAP DRILL SIZES

THE NATIONAL THREAD SYSTEM FOR SCREWS, BOLTS AND NUTS, as recommended by the National Screw Thread Commission in report dated June 19, 1920.



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Size	No. of Threads Per Inch	Basic Pitch Diam. Inches	Nut Minor Diam.		TAP DRILLS		
			Min. Inches	Max. Inches	K1 Min. Inches	K2 Max. Inches	Equivalent Regular Size
No. 0	80	.0519	.0465	.0478	.0472	.0477	1.2 mm.
No. 1	72	.0640	.0580	.0595	.0588	.0593	1.5 mm.
No. 2	64	.0759	.0691	.0708	.0700	.0705	No. 50
No. 3	56	.0874	.0797	.0816	.0807	.0812	No. 46
No. 4	48	.0985	.0894	.0917	.0906	.0911	*
No. 5	44	.1102	.1004	.1029	.1019	.1024	2.6 mm.
No. 6	40	.1218	.1109	.1136	.1125	.1130	No. 33
No. 8	36	.1460	.1339	.1369	.1355	.1360	No. 29
No. 10	32	.1697	.1562	.1596	.1584	.1590	No. 21
No. 12	28	.1928	.1773	.1812	.1794	.1800	No. 15
¼ Inch	28	.2268	.2113	.2152	.2124	.2130	No. 3
5/16 "	24	.2854	.2674	.2719	.2697	.2703	*
⅜ "	24	.3479	.3299	.3344	.3314	.3320	Q
7/16 "	20	.4050	.3834	.3888	.3854	.3860	W
½ "	20	.4675	.4459	.4513	.4486	.4492	*
9/16 "	18	.5264	.5024	.5084	.5054	.5062	*
5/8 "	18	.5889	.5649	.5709	.5679	.5687	*
11/16 "	16	.7094	.6823	.6891	.6867	.6875	11/16 in.
¾ "	14	.8286	.7977	.8054	.8016	.8024	*
1 "	14	.9536	.9227	.9304	.9266	.9274	*
1 1/16 Inches	12	1.0709	1.0348	1.0438	1.0393	1.0401	*
1 1/8 "	12	1.1959	1.1598	1.1688	1.1643	1.1651	*
1 1/4 "	12	1.4459	1.4098	1.4188	1.4143	1.4153	*
1 3/4 "	12	1.6959	1.6598	1.6688	1.6643	1.6653	*
2 "	12	1.9459	1.9098	1.9188	1.9143	1.9153	*
2 1/4 "	12	2.1959	2.1598	2.1688	2.1644	2.1654	55 mm.
2 1/2 "	12	2.4459	2.4098	2.4188	2.4143	2.4153	*
2 3/4 "	12	2.6959	2.6598	2.6688	2.6643	2.6653	*
3 "	10	2.9350	2.8917	2.9026	2.8972	2.8982	*

FIG. 2. TAP DRILL SIZES, FINE THREAD SERIES

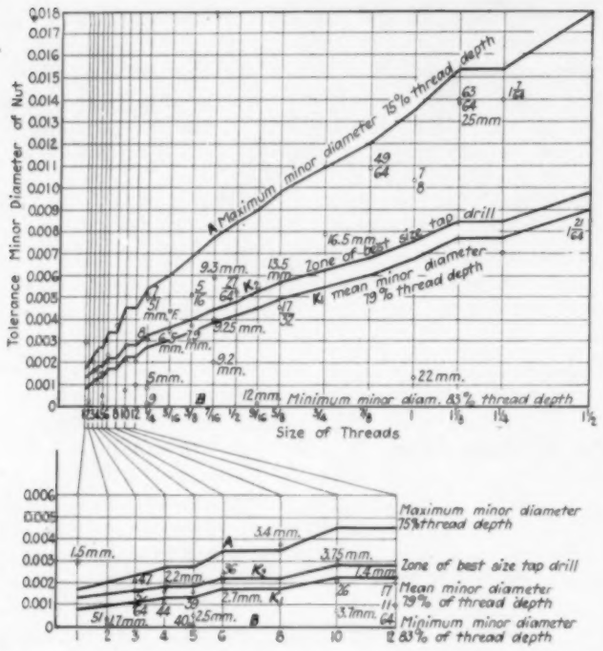

Tolerance Minor Diameter of Nut
Maximum minor diameter 75% thread depth
Zone of best size tap drill
Mean minor diameter 79% thread depth
Minimum minor diameter 83% thread depth
Size of Threads

FIG. 3. TAP DRILL SELECTION CHART, COARSE THREADS

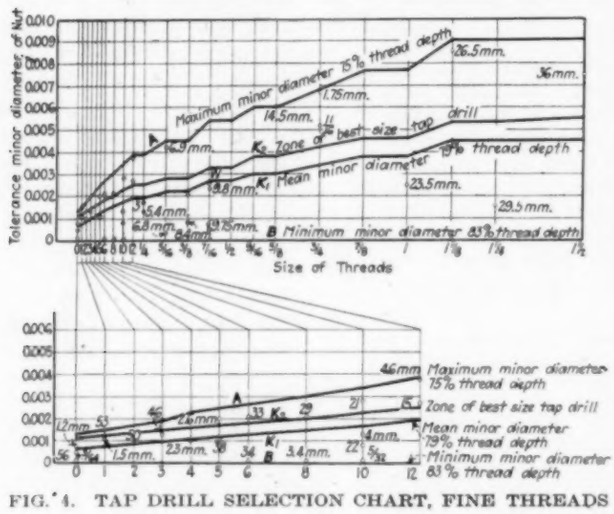

Tolerance minor diameter of Nut
Maximum minor diameter 75% thread depth
Zone of best size tap drill
Mean minor diameter 79% thread depth
Minimum minor diameter 83% thread depth
Size of Threads

FIG. 4. TAP DRILL SELECTION CHART, FINE THREADS

tinuing its work. The progress report will be augmented to include more information as to the specific class of fit and series of thread pitches to be used under different conditions.]

Decreased Imports Affect Exports

(From the *Guaranty Survey*)

It is, of course, important that the highest possible volume of export trade should be maintained if we are to have normal production in our mines and factories and on our farms, and if we are not to be forced to scrap a large part of our new productive equipment. But an increase in imports does not necessitate a corresponding decrease in exports. It is entirely possible that the present relation between exports and imports may be reversed without in any way decreasing the volume of exports. We can buy more without selling less and thereby enable our European debtors to pay off their obligations without crippling our industries or decreasing our national wealth in order to do so. A study of the development of foreign trade in many European countries will show this to be true.

Quick Removal of a Pavement

BY D. E. DUNN

About a year after the armistice was signed many large plants were being remodeled for peace-time production. One large manufacturer of compressed-air machinery had an entire building with many thousands of square feet of floor space devoted to war work. In the remodeling of this building, which was in the Phillipsburg, Pa., plant of the Ingersoll-Rand Co., the floor had to be torn up. An idea of the size of the job can be obtained from Fig. 1.

Naturally the first thought was to do it by hand, as

FIG. 1. BREAKING UP FLOOR OF A LARGE PLANT

FIG. 2. PAVING BREAKERS AT WORK

it had always been done that way. However, some one suggested using paving breakers. These machines are compressed-air operated, one-man tools very similar to non-rotating hand-hammer rock drills; and they are especially intended for concrete, masonry and paving demolition work.

On the job no exact records were kept. However, a fairly accurate estimate showed that two paving breakers broke up about 3,000 sq. ft. of 3- to 7-in. thick concrete in one twelve-hour period. In doing this work it was necessary to exercise the utmost care in some cases to prevent breaking through the ceiling to the floor below. For this reason the greater part of the work was done by driving a chisel-shaped tool under the paving and prying it up, as shown in Fig. 2.

It was estimated that it would take about thirty men using the old hand methods to accomplish in the same length of time the same amount of work as the two machines mentioned performed.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Cutting a Keyway in the Hub of a Large Wheel

BY JOHN B. HABERLE

I recently had occasion to bore and cut a keyway in a large flywheel that was all out of proportion to any tools in our shop. The wheel weighed 4 tons and was

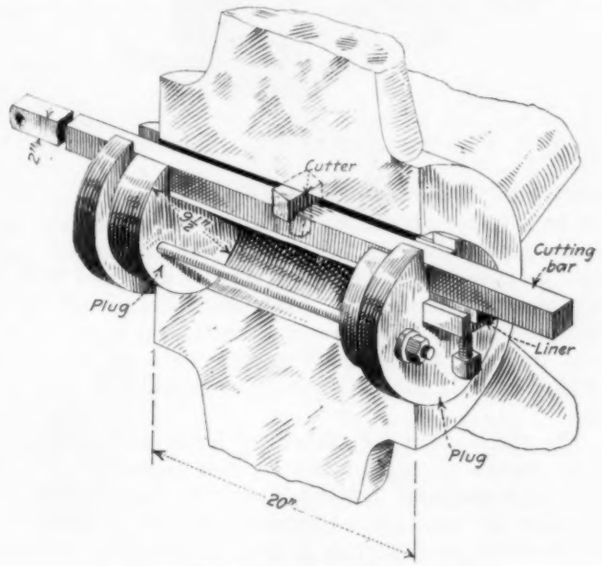


FIG. 1. THE SET-UP

9 ft. 2 in. in diameter. The hub was 20 in. long with a 9½-in. hole.

The boring was a comparatively simple matter but the cutting of a keyway 2½ in. wide by 20 in. long, ⅜ in. deep at one end and 1 in. at the other—was a job that required a good deal of thinking. The way it was finally done is shown in the accompanying sketch.

I made two short shouldered plugs to fit the bore, with slots to take a 2-in. square bar of cold-rolled, and held them in opposite ends of the bore with through bolts. The slots in the plugs were deep enough to allow room for the cutting tool, which was set in the bar, and also to accommodate a liner under the bar to take care of the feeding. This liner rested on setscrews, tapped through lugs on the outside of each plug.

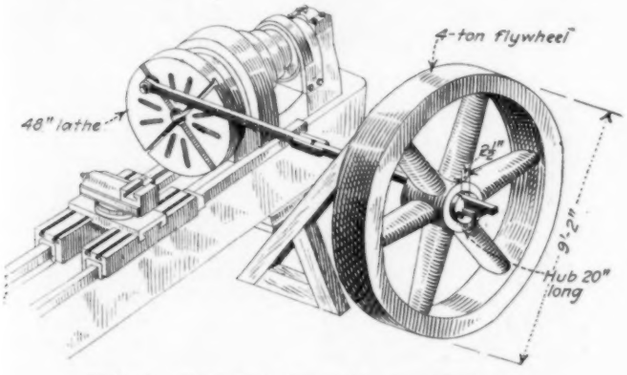


FIG. 2. DETAILS OF THE CUTTING BAR

The wheel was set up and braced before a 48-in. lathe with the wheel hub in line with the faceplate. A pitman, reaching from the end of the cutter bar to a stud in the faceplate, completed the device. I was able, by constant attention to the setscrews, to cut a satisfactory keyway to the required depth in about five and one-half hours. The details of the rig and the manner in which it was set up are shown in the illustrations.

Know Why You Do Things

BY ELLSWORTH SHELDON

A series of articles, started by A. W. Forbes on page 612, Vol. 53, of the *American Machinist*, under the general heading "Know Why You Do Things," and continued by various writers on page 883 of the same volume and pages 72, 229, 238, 367, 565, 657, 832 and 880, of Vol. 54, seems to hinge upon the question of whether a cutting tool in a lathe should be set above, below, or at the same level as the center line of the lathe.

The contention of the writer of the original article was that occasional extraordinary conditions demanded extraordinary methods to meet them and that every lathe operator should study out the reason *why* he did certain things in a certain way in order to know *when* he should depart from his usual custom and do them in some *other* way.

Mr. Forbes' point was well taken but unfortunately illustrated. He chose as his experiment a "chattery" lathe and explained (on page 72, Vol. 54) *one* of the reasons why chatter occurs; showing in outline sketch a condition that would induce chatter, to counteract which he would place the cutting edge of the lathe tool below the center of the work.

The expedient, though doubtless more or less successful in certain cases, was so radical a departure from usual practice that it overshadowed the real point of the original article and became the bone of contention around which succeeding writers built their arguments pro and con; mostly con.

It is my belief, confirmed by a practical experience covering a period of nearly forty years, that the setting of a cutting tool is entirely a matter of rake and clearance angles; and that although chattering may sometimes be reduced or eliminated by changing the position of the tool, the same effect would have been produced by altering the angles by grinding. In other words, the chattering is the result of wrong conditions in which the position of the tool is seldom at fault, and to change it is merely to impose *another* wrong condition to, in a measure, cancel or offset the first.

Mr. Forbes' sketch, reproduced herewith in Fig. 1, shows a faulty tool support, exaggerated for purposes

of illustration. The obvious remedy in such a case would be to run the toolblock forward and withdraw the tool to correspond. Moreover, to eliminate the chatter by placing the tool in such position that it would spring away from, instead of toward, the work would necessitate bringing the edge down to the position indicated by x, the point of incidence of the circle of the work and the arc of deflection. And I doubt if even Mr. Forbes would advocate placing it so low.

It has been my experience that chatter is more often counteracted by decreasing the clearance angle than by increasing it; and this means, unless the tool is either reground or tilted, setting the cutting edge *up* and not *down*.

On page 880 appears another proponent of what seems to me to be the wrong idea, and to illustrate his point he shows two tools, reproduced in Fig. 2, both of which to me show the error, the cause of trouble, to be in themselves and not in the manner of their setting. It is hardly necessary to explain to the readers of the *American Machinist* the reason why a springy tool may cause chatter. If the point of resistance, the cutting edge, is so placed in relation to the point of flexure that it occupies a position above a straight line drawn from the center of rotation of the work to the center of flexure of the tool (above being

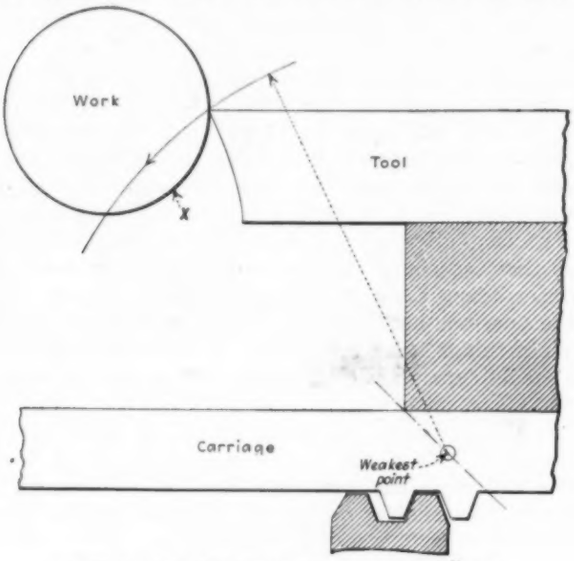


FIG. 1. MR. FORBES' ORIGINAL SKETCH

understood to be *against* the direction of rotation), chatter is a natural and inevitable result; but the point of flexure and the point of support of the tool are not of necessity related, and they are distinctly *not* so related in the two tools illustrated.

With a tool ground to so thin an edge as is indicated by the upper of the two tools shown in this figure, the point of flexure is located very close to the edge itself and almost directly under it and it would seem to me to be practically impossible to get a smooth cut with such a tool. In the lower tool an attempt has been made, by introducing the gooseneck, to raise the point of flexure so that the cutting edge falls below the above-mentioned line; which would have been an excellent expedient if the designer had not introduced another, and much less resistent, point of flexure at x which is bound to make trouble unless the tool is so tilted as to bring this point below the line.

If a lathe spindle is properly fitted to its bearings and the lathe itself so proportioned as to impose a proper resistance to the pressure of the cut, the height,

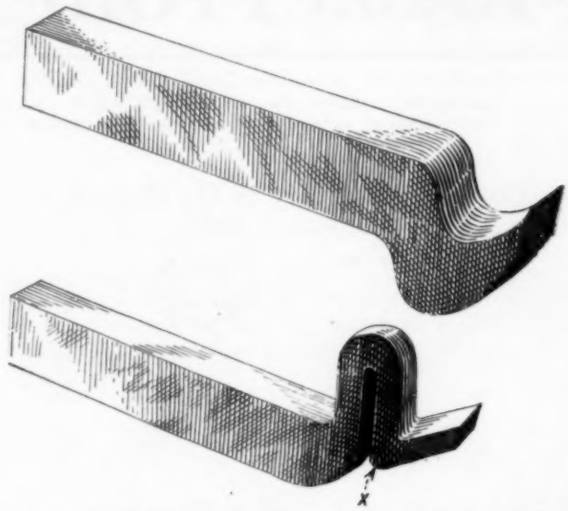


FIG. 2. TWO TOOLS THAT WILL CHATTER ANYWAY

relative to the center line, at which the tool is set, will not be a factor at all; the tool could as well be set vertically either directly below or above the center line. But, because the lathe is usually so designed that it best resists a downward thrust and because all movements of the toolslide are in a horizontal plane, it follows that the theoretically proper place to locate the cutting edge is in the same plane relative to the centers.

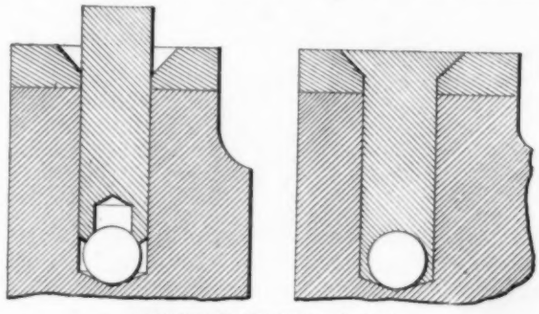
The real reason for raising or lowering a tool point is to change the rake and clearance angles to suit the work and material in hand, and it is more convenient to make the requisite adjustments in this respect with the toolpost wrench than it is to maintain a sufficient assortment of tools to meet all conditions.

My advice to mechanics endeavoring to correct chatter by monkeying with the tool is in effect the same as Mr. Forbes tried to convey in the original article: Find out what causes the chatter and correct it once for all time; then you can put the tool anywhere that may be desirable without reference to the center. For example see any automatic screw machine.

Holding a Rivet in a Blind Hole

BY FRANK C. HUDSON

The use of a ball for spreading the end of a rivet in a blind hole frequently comes in very handy, as shown by F. G. McCormack on page 1095, Vol. 54, of the *American Machinist*. A more solid job can probably be made by using a rivet with a hollow end instead of



RIVET HELD BY A BALL

being split, as was done by the Link-Belt Company back in the early part of the present century.

Mr. McCormack will be interested to look back on page 1011, Vol. 32, issue of Dec. 9, 1909, to see the application of this device as practiced by the Link-Belt Company at that time. He will also note that James M. Dodge, then president of the company, gave the use of the device, which they had patented, to anyone who desired to use it.

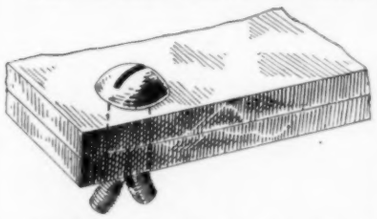
For the benefit of those who may not have access to the volume mentioned, I am reproducing the method as used by them. Studs of this kind have about the same strength as bolts. Although it might seem that it would be better to undercut the bottom of the hole with a wobble drill, it was not their practice to do so. It can, however, be done should it seem desirable. The illustrations make the method perfectly clear. The proper proportions are given herewith:

	In.	In.	In.
Diameter of stud	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{9}{16}$
Depth of hole	$\frac{3}{4}$	$\frac{7}{8}$	
Size of ball	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$
Diameter of center bore	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$
Depth of center bore	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$

A Handy Lock Bolt

BY CHARLES H. WILLEY

The sketch shows a useful kink that may be employed on small screws and bolts where it is desired to keep them from coming loose. Just use a longer screw that will give you a chance to saw a slot in it and spread the slit end apart, as shown. The idea is good on sheet-iron work.



LOCKING A NUT ON A BOLT

A Handy Rack for Drills and Reamers

BY CHARLES H. WILLEY

I picked up a rather good idea in a small shop and I have endeavored to show it in the sketch herewith. It was a tray, or rack, for holding reamers and drills

RACK FOR DRILLS AND REAMERS

and was simply a shallow wooden box lined with a piece of corrugated iron; the corrugations serving to keep each tool separate.

Grooving a Large Hoist Drum

BY C. M. O'HARA

Having a number of large skip hoist drums to groove, and being unable to swing them on our largest lathe, we made use of a 10 to 16 ft. Betts boring mill as shown in Fig. 1. This made a very satisfactory job.

The upright housings, being movable, were set back

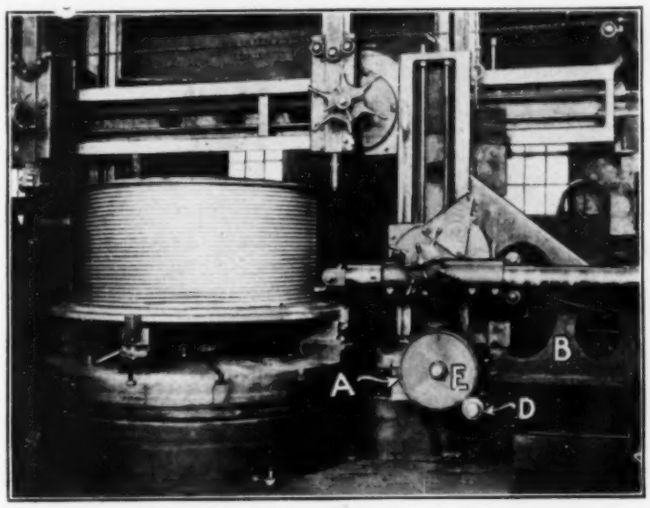


FIG. 1. GROOVING A LARGE DRUM ON A BORING MILL

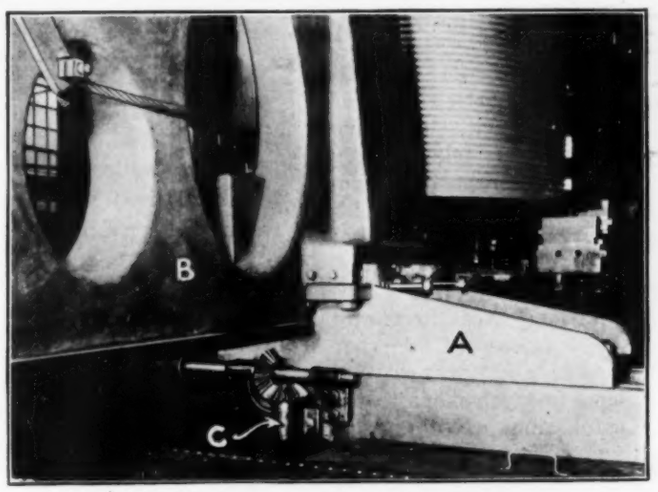


FIG. 2. DETAILS OF FEED MOVEMENT

about 4 ft. and a base *A*, Fig. 2, made and bolted securely to the part of the ways thus exposed. On this base was fastened the extension arm *B* that is a part of the standard equipment of the mill.

A bracket *C* serves as an outboard bearing for the feed shaft, on one end of which is located a miter gear, meshing with a similar gear, which is the original feed drive for the machine. This same shaft carries on the opposite end the index gear *D*, Fig. 1, used in generating the required lead.

The ratio of travel between the drum and the feed shaft was found to be $16\frac{3}{8}$ to 1, and knowing the lead of the screw it was an easy matter to figure the gears *D* and *E* to generate the correct lead. By means of compound gearing an almost unlimited number of threads can be chased.

An angle iron bracket, cable and counterweight complete the equipment. The drum shown in the illustration is 69 in. in diameter, $36\frac{1}{4}$-in. face, 1.1875-in. pitch, 2.375-in. lead, double thread, right hand.

IN THIS ISSUE

WHILE the larger part of the civilized world is house-cleaning after the recent universal fracas, many manufacturing businesses are taking advantage of the lull in production to readjust shop conditions—putting the house in order to meet the keen competition which is inevitable. Firms that have been running along in the same old rut for many years are now able to see that they must introduce practical methods for handling materials and paying the workmen. All of which means that they are at last appreciating the importance and the responsibilities of management. In order to help convince the recalcitrant and to give them guidance once they are converted we have been for a long time very liberal with our management articles. We are encouraged by indications that our work is bearing fruit and continue the drive. There are several articles in this issue that will prove to be of material assistance.

The first article, "Incentive or Production Basis of Wage Payment," by Henry H. Farquhar, takes up six major administrative functions in their proper order and shows of just what each consists. Mr. Farquhar explains what conditions are necessary to the success of any shop system and proves that there is much more to the installation of a system than the holding of a stop-watch. The uses of motion study and time standards are clearly brought out.

The second article, "The Layout of a Modern Machine-Tool Plant," by Colvin, page 173, deals with another phase of modern plant management. It is still necessary to build a plant according to the space available or a given amount of cash. But while so doing it is equally necessary to lay out the operations on the various parts, determine the methods of machining, figure out the number of machines needed, and then adjust the construction to the layout and number of the machines. We shall have more on plant layout in the near future.

The promised series on machining the Wrigley automobile transmission gear, by I. William Chubb, editor of our European edition, begins this week, page 176. The first article describes the system in use in an English plant, with reproductions of the forms in use. His description of the progressive operation system will be very interesting to our American production experts.

Tool engineering continues with the subject of milling fixtures, including this week descriptions of methods of supporting and clamping thin castings and explaining the use of pneumatic clamps. Milling machine work offers great possibilities for originality in the designing of time- and labor-saving fixtures, and the illustrations in this article are fine examples of this class of work. Page 179.

In this, the 19th installment of "Modern Production Methods," page 184, W. R. Basset tells how to determine the condition of a business frequently and easily. Older methods have given place to the newer, in the office as well as in the shop, and the necessity of closing the books in order to find out where the business stood, is also a thing of the past.

Another article by Fred H. Colvin is "Facilities at the Puget Sound Navy Yard," page 188. It includes descriptions of a six-ton electric steel furnace and tells how it is operated. Operations in marine engine construction also are described and illustrated.

Those who read Elmer W. Leach's first article on "Organization and Management of the Small Shop" discovered that Mr. Leach speaks with the assurance of one who is thoroughly conversant with this subject. The second installment, page 190, deals with marketing and manufacturing problems and includes a questionnaire which will help the manufacturer to find out a lot of things about his own product. Mr. Leach gives a lot of good advice concerning expenditures for equipment and tells how he conserved his resources when everything was going out and nothing coming in. Here is a characteristic statement: "In considering the possibilities of the success of your business venture, correct information is your most essential requirement. Until your decisions are based on certain conditions of fact, they are sheer guesswork and you are risking your money and prestige and the possibility of success."

Entropy is back from a somewhat protracted vacation with a refreshing letter on co-operation, page 193. An old subject, co-operation, but never worn out.

Coming Features

The leading article in next week's issue will be devoted to a foundry subject. William H. Parry has written a very comprehensive article on elevated, midway and subway gating.

There will be a railroad shop article, by Fred H. Colvin, on tools for boring and turning locomotive tires. The data were obtained from seventeen railroad shops located in various parts of the United States and Canada. This is the first of two articles.

The sixteenth installment of Tool Engineering will continue the subject of the design of milling fixtures.

There will be two other series articles next week, the third installment of "Manufacturing with Special Machines versus Standard Equipment," by Col. G. F. Jenks, and the fourteenth of DeLeeuw's "Metal Cutting Tools." We shall publish only the first half of DeLeeuw's article. It will be continued in the following issue.

EDITORIALS

Rewards for Suggestions

SUGGESTION systems have many advocates while others have failed to find them of any benefit whatever. As with many other devices and methods, almost everything depends upon the way it is handled. Suggestion boxes can be a source of real improvement but it is usually up to the management more than to the men.

One of the stumbling blocks is the question of reward for suggestions which prove of value. In too many cases an arbitrary amount is named which is usually much too small if the suggestion is of any real use. Sometimes it is doubtless all that the suggestion is worth, but in such cases an honorable mention would probably answer equally well.

Some plants do not find a direct financial reward desirable and use other methods of showing appreciation. But where prizes are offered the reward should be adequate without too much bookkeeping.

In a shop paper published by a large concern we recently saw the announcement of an award of $10 for a device which was proving very valuable in increasing production. How far is such meager recognition going to stimulate the valuable suggestions? What would have been paid to an efficiency engineer for such a suggestion? How much have we paid outside men for ideas which failed to save anything?

It is not an easy task to fix the value of a suggestion fairly. But if it saves money there should be some way of calculating a suitable reward, based on the saving effected.

As with so many other phases of management, this is an opportunity for taking counsel together. All men prefer to have a hand in making a plan rather than in having it handed to them ready-made. They will usually be found amenable to reason if approached in the right way.

The Administration Moves for Better Times

THREE recent moves of the Administration at Washington are full of promise of an improvement in commerce and industry in this country and abroad.

Mr. Harding's call to a disarmament conference was heartily received everywhere. The potential benefits lying in such a conference are almost boundless. Aside from the moral aspects of any agreement that will tend to prevent the settlement of international disputes by force of arms, consider for a moment the stimulus to business of the release of the tremendous amounts of capital now devoted to the military establishment, and their diversion to peaceful ends. And also the reduction in taxation which is sure to follow.

In the second place there are the vigorous efforts of Mr. Harding and Mr. Hoover to hasten the payment of the hundreds of millions owed by the Government to the railroads. Many people feel that the payment of this money would be the one greatest step toward the return of prosperity. Some railroads, it is said, have not paid any bills for a year. As a consequence their creditors have been hard pressed for liquid capital to finance their business and have been quite unable to expand. It does not require a very vivid imagination to foresee the results of what might be called the thawing of five hundred millions of frozen credits.

And then there is the plea for the postponement of bonus legislation. We stand with every other right-minded American in believing that everything possible should be done for wounded and disabled veterans of the war. We feel, however, that this is not the time for passing a cash bonus bill that would add several billions to our national debt. There is even some question among financial men as to whether the bonds to finance a bonus could be sold. The action of the Senate in recommitting the bill will be a relief to many.

Expensive Economy in Buying Tools

THE feeling that money must be carefully spent is to be commended. But too many are not giving due consideration to the real meaning of the word economy. The old purchasing agent attitude of getting whatever can be bought cheapest, is again having its fling. And it is very expensive economy.

The purchasing of milling cutters is a case in point. The price per cutter is of little importance—it is the price per cut that counts.

Many seem to forget that milling cutters are the business end of a high-priced machine and that every minute the machine stands idle the overhead goes up with amazing rapidity. Cutters that will stand up without regrinding for a long period are worth many times their cost as compared with those which require frequent sharpening.

In one case the difference in cost of a part of a machine was almost five to one. One set of cutters made the milling cost ninety-eight cents per piece while with the other and cheaper cutter, the cost was $4.80. The difference was due principally to the time taken to regrind and re-set the cheaper cutters, although the other cutters were also able to stand more feed.

In another case an automobile builder was about ready to put in an expensive grinding equipment to handle some very hard connecting-rod work. A cutter maker, or more correctly speaking a cutter engineer, designed and made some cutters which would do the work and utilize the present equipment. And more than that, they are milling 1,000 rods between grindings.

Every user of cutting tools, and that means every user of machine tools, should study the problems of his cutting tools. Are they doing the best possible work? Are they properly designed, properly made, of the best material? Unless you are sure you know, it will pay to call in cutter engineers and get the benefit of their experience. Don't buy cutting tools solely on a price basis. Buy cutters of all kinds on the basis of performance, bearing in mind especially the cost of idle time on the machines which use them.

The lowered cost of milling or drilling may put you on the right side of the ledger when you begin getting your shop back on a manufacturing basis.

Shop Equipment News

Dalton Combination Lathe, Milling and Drilling Machine

A combination machine, designed primarily for use in garages, on shipboard, and in other places where a rather complete equipment is required and floor space is at a premium, has been placed on the market by the Dalton Manufacturing Co., Sound Beach, Conn. A general view of the machine is shown in Fig. 1, while Fig. 2 is an end view which will give an idea of the completeness of the milling and drilling equipment.

A single hollow spindle serves both the lathe and the milling machine. It has a No. 10 B. & S. taper hole in the milling machine end and a No. 4 Morse taper hole in the lathe end. The lathe swings 13 in. over the shears, and will take 37 in. between the centers. By removing a section of the shears next the headstock, it becomes a gap lathe, capable of handling faceplate work 18½ in. in diameter by 6½ in. long. The block is held in place by a tapered dowel bolt, and may quickly be removed or replaced.

The cross-slide has a travel of 12 in., and is fitted with a compound rest. The head has a three-step cone, and is provided with a single back gear, giving a speed range from 20 to 441 revolutions per minute. The lead screw is 1 in. in diameter, and has an 8-pitch Acme thread. Change gears are provided to cut all standard threads, including 11½, from 3 to 56 per inch. Gears for metric threads can be supplied.

The milling machine table has a working surface of 24 by 7½ in., and a longitudinal feed in either direction of 15 in. The transverse movement is 6¼ in., and the knee can be adjusted vertically through a distance of 13¼ in. A telescopic elevating screw obviates the necessity for boring a hole in the floor. An overarm is provided, the clearance being 5¾ in. from the center line of the spindle. There are three changes of table feed, ranging from 0.0058 to 0.098 in. per revolution. A vise is supplied, having jaws 1½ x 3¾ in. and opening 3 inches.

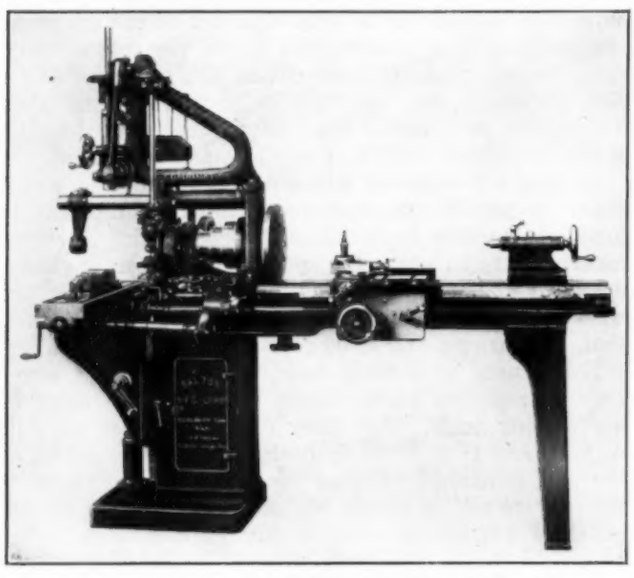


FIG. 1. DALTON COMBINATION MACHINE TOOL

The drill press can be used only by removing the overarm of the milling machine. A round table is furnished, to be attached to the table of the milling machine. The machine will drill to the center of a 16-in. circle, and the spindle has a vertical travel of 9 in. The maximum distance from the end of the spindle to the milling machine table is 23 in. With the round table in use this distance is 18 in. The spindle can be locked rigidly in any position of its vertical travel, and it then becomes a vertical milling machine, having all the movements of a standard machine. The hole in the spindle is No. 3 Morse taper. Handwheel and worm, as well as lever feed is provided for the vertical movement. The spindle sleeve is 9¾ in. long and 2¼ in. in diameter. The spindle has speeds from 15 to 48 r.p.m. with the back gears in use and from 107 to 331 r.p.m. without them.

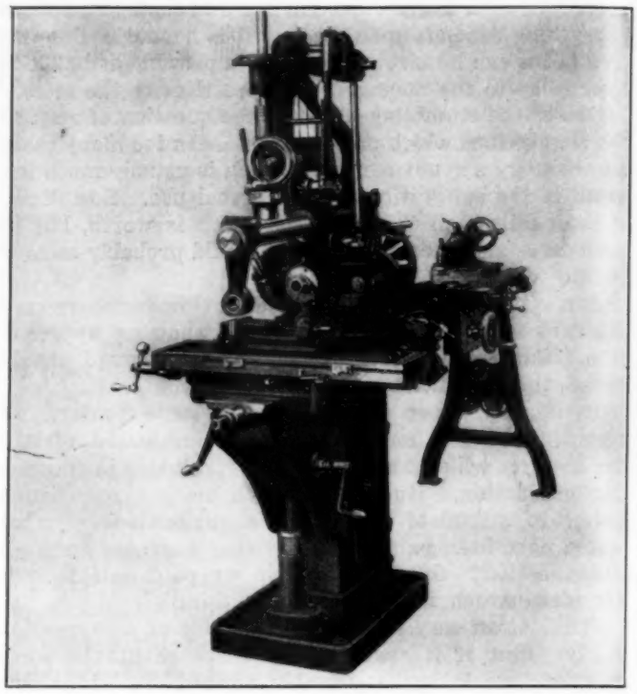


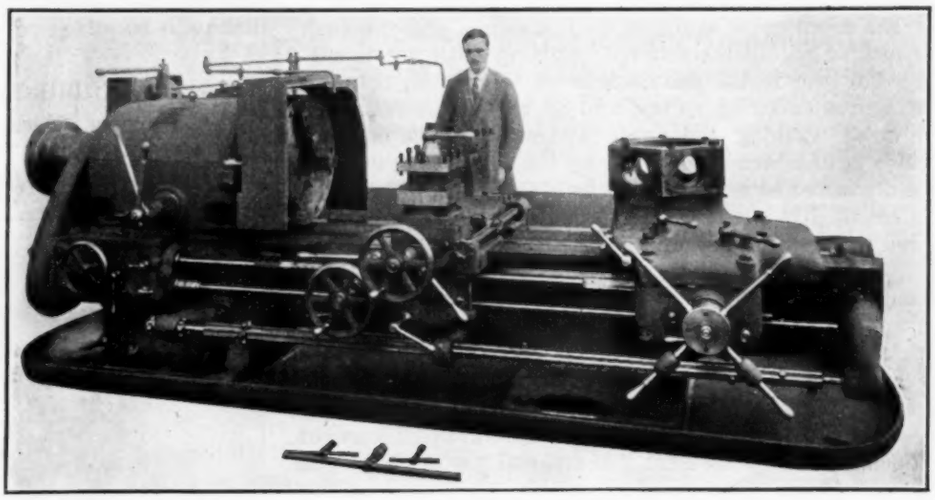
FIG. 2. MILLING AND DRILLING END OF DALTON COMBINATION MACHINE

While the lathe and milling machine, or the lathe and drill press, may be used simultaneously, the tool is intended as a one-man machine. It can be set up on a floor space of 40 sq.ft., including the room necessary for the operator to get around it. A reversing countershaft is furnished with the machine, with pulleys 8 in. in diameter by 3½-in. face. The countershaft should run at 250 revolutions per minute, in order to give the proper spindle speeds.

The outside dimensions of the complete machine are: length, 7 ft. 10 in.; height, 6 ft. 5 in.; width, 3 ft. 1½ in. The net weight is about 2,000 pounds.

Alfred Herbert No. 20 Combination Turret Lathe

Alfred Herbert, Ltd., Coventry, England, and 50 Church St., New York, N. Y., has recently added a larger size of machine to its line of all-geared combination turret lathes. The machine is now made with a hole through the spindle to accommodate stock 7 in. in diameter, and is known as the No. 20 model. The largest size formerly made, described on page 1016, Vol. 52, of the *American Machinist*, had a capacity of 4⅝ in. The lathe is intended especially for handling the larger sizes of castings, forgings and bar stock on production work, the making of machine spindles being one application.



HERBERT NO. 20 COMBINATION TURRET LATHE

It is claimed that the small details have been taken care of, so that the machine is easy of operation. Heavy guards are provided for all gears, so as to lessen the liability of accident. It is stated that the labor of operating the machine has been reduced by such means as a power traverse for the turret, automatic lubrication and large handwheels.

The headstock provides sixteen spindle speeds in each direction, the chrome-nickel steel gears running in oil. All the shafts run on ball bearings, a ball thrust bearing being used for the spindle. The 18-in. drive pulley is driven by means of a 5-in. belt at a speed of 400 r.p.m., the shaft running on ball bearings. A friction clutch is incorporated in the drive, although the clutch can be positively locked for taking heavy cuts.

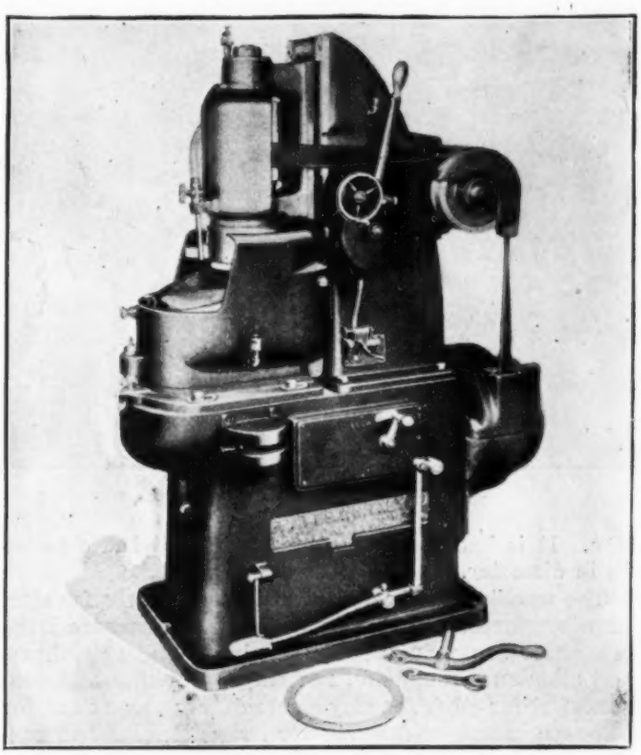
The machine allows a swing of 28 in. over the bed. The maximum distance from the flange of the spindle to the face of the turret is 72½ in. The feed box under the headstock gives eighteen feeds to the turret slide, the changes being made by rotating the handwheel. The feeding and chasing mechanisms are interlocked but independently controlled, the chasing leader and nut being changed to suit the pitch required. Nine feeds are provided for the saddle, which carries a square toolholding turret. The main turret is horizontal, hexagonal in shape and is indexed manually. Two coolant pipes are provided, as well as large guards to prevent splashing.

Pratt & Whitney 8-Inch Rotary Surface Grinding Machine

The Pratt & Whitney Co., Hartford, Conn., has recently placed on the market a rotary-table surface grinding machine having an 8-in. wheel. The machine, shown in the illustration, is intended primarily for the grinding of disks, rings and cylinders requiring flat and parallel surfaces. The maker claims that the sturdy, compact construction permits of heavy cuts, and that the sensitive adjustments provide for rapid production on gear blanks, washers, cutter-hubs, or other work requiring great accuracy. Means are provided for grinding concave or convex surfaces.

The spindle is mounted on ball bearings, which are protected from dirt and provided with adjustments for wear. The wheel is cemented in a holder screwed to the spindle, to facilitate changing, and a band clamped around the wheel guards against breakage. Surrounding the wheel is an adjustable steel guard which automatically covers the entire wheel when it is raised to the idle position, so that chuck work can be handled safely.

The wheel feed is controlled by a lever, as on a sensitive drill press, and a positive stop is provided for grinding to a specified thickness. Fine adjustments are made through a handwheel, which can be locked and used as a feed wheel when desired. Back lash is neu-



PRATT & WHITNEY 8-IN. ROTARY SURFACE GRINDING MACHINE

Specifications: Wheel: diameter, 8 in.; height, 3 in.; thickness, ½ in. Chuck to wheel, 0 to 5 in. Table diameter, 10 in. Speeds: wheel, 2,000 r.p.m.; chuck, 50 and 100 r.p.m.; countershaft, 450 r.p.m. Motor (on order), 7½ hp., 1,800 r.p.m. Floor space, 31x55 in. Weight: net, 3,000 lb.: crated, 3,150 lb.; boxed, 3,500 lb. Export box, 80 cu.ft.

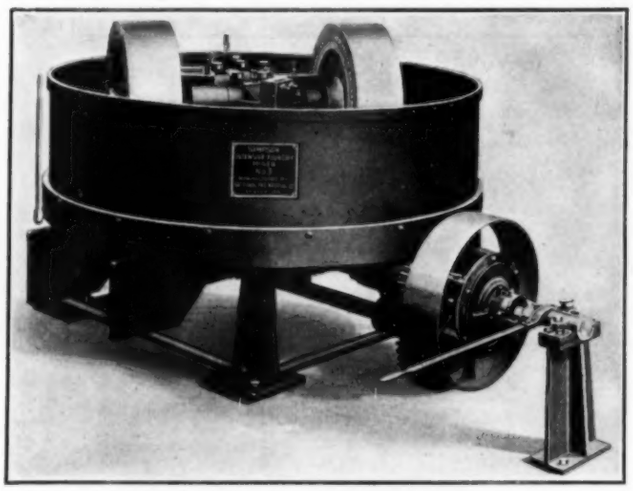
tralized, and the wheelslide is over-weighted for easy control. The rotary magnetic chuck has two speeds, and can be tilted for concave or convex work. This chuck is controlled by a pedal, and a connected brake retards the rotation when stopping. The magnetic chuck is controlled through a switch on the side, which also acts as a demagnetizer.

The machine is equipped with a pump, and the tank is located within the column. Cutting lubricant is supplied to the inside and outside of the wheel, the flow being regulated by valves, and an adjustable hose permits of washing the chuck and work. The shut-off valve is ordinarily controlled by the feed lever, but can be disconnected and operated by a pull knob. The spray is confined by a guard, the front of which can be lowered to facilitate handling the work.

Belt drive is regularly furnished, all necessary guards being provided. The main drive shaft and idler pulleys are mounted on ball bearings and the clutch is mounted on a thrust bearing to take the load. The two-speed gear shaft is mounted on bronze bearings and the gearing runs in oil, the bearings being lubricated by the splash system. A flexible coupling takes care of chuck tilt and alignment. Individual motor drive can be furnished. The standard equipment comprises two wheel mounts, one grinding wheel, a wheel dresser, countershaft, and the necessary wrenches.

Simpson No. 3 Sand Mixer

The National Engineering Co., 549 W. Washington Blvd., Chicago, Ill., has placed on the market a larger size of its Simpson sand mixer, shown in the illustration. It is known as the No. 3 size, and has a pan 8 ft. in diameter.



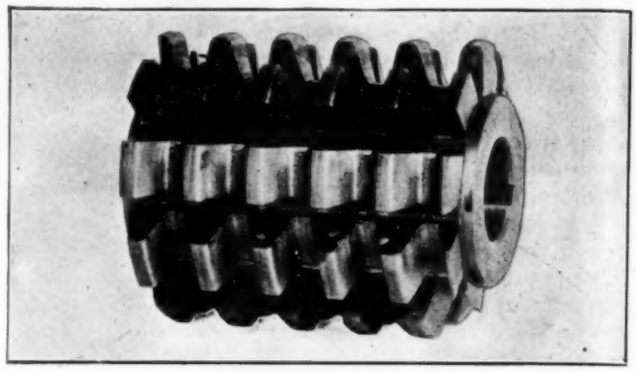
SIMPSON NO. 3 SAND MIXER

The machine has been developed particularly for steel foundry purposes, but it can also be used where large capacities are required in gray-iron, malleable, brass and aluminum foundries, not only for facing and core sand, but for other foundry sand mixtures, as well as for the preparation of daubing for lining cupolas and furnaces. It is claimed that the time for mixing is brought down to a minimum, because of the mixing action, which is done by a combination of plows and mullers. The horsepower is said to be low compared to the capacity, which is increased by the use of the automatic discharge.

Most of the parts are of cast steel. The machine is strongly built and intended to give continuous service with a low cost for maintenance. It is said to work at maximum capacity, with very little labor for the operation of the machine; and to produce the highest quality of mixture, giving uniform results because of the thorough distribution of the new sand or binding element that is to be mixed.

Simmons Method-Hob

The Simmons Method-Hob Co., 2nd St. and Duncannon Ave., Olney, Philadelphia, Pa., has recently placed on the market hobbing cutters that are produced by a method in which the teeth are generated on special machines. The cutter, shown in the illustration, is known as the Simmons method-hob. The hobs are claimed to be mechanically accurate, as they are produced by a generating action, a feature which makes it possible to duplicate them absolutely.



SIMMONS METHOD-HOB

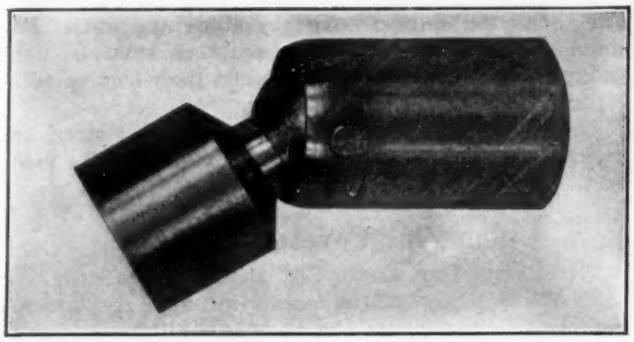
When cutting large numbers of gears of one kind, the hobs, of course, wear out. It is necessary to be able to produce a new hob that is an exact duplicate of the original one when new. This is possible, it is claimed, as each hob is an exact duplicate of the others, because each hob is an original master generated by mechanical means on the same or similar machines and by the identical mechanical movement.

The generating of the hobs is perfectly practical, the maker states, because the method follows "the law of the involute." No forms or templates are used to determine the tooth contour. Hobs for different forms of involute tooth, both standard and stub, can be furnished, the cutter being made to suit the requirements in such matters as pitch, pressure angle and number of threads. The importance of hardening in hob making is recognized, as a special method of hardening is said to be employed.

Apex Screwless Universal Joint

The illustration shows a universal joint recently placed on the market by the Apex Machine Co., Dayton, Ohio. The joint is intended especially for use in driving the spindles of multiple-spindle drilling heads, although it can be adapted to all sorts of light and medium-duty drives. The maker claims that the device will fit all multiple-spindle drilling and tapping machines, and that it will drive with the shafts at angles of 35 deg., or in special cases on light drives at 45 degrees.

The principal feature of the joint is its simplicity

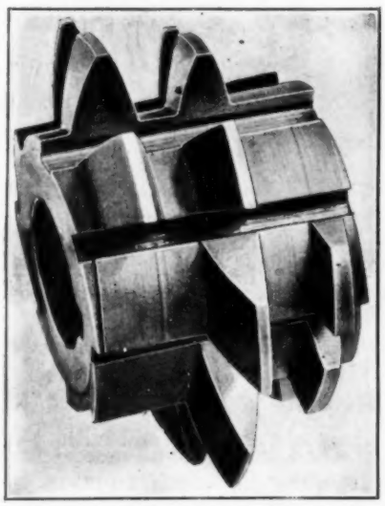


APEX SCREWLESS UNIVERSAL JOINT

of construction, there being no screws used in it. The parts, which are heat-treated and interchangeable between joints, consist of one cup end, one ball end, one journal rocking pin, one driving pin, and one locking ring. The driving pin which passes through both the main members, is pressed into the journal or rocking pin, which can be seen in the ball end, and is held there by the locking ring. By virtue of the two pivots, movement in any direction can be obtained. There are thus no projecting ears or center blocks required, it being claimed that no wedging action can occur and that friction is very slight. The joint is made in all sizes from ⅜ in. in diameter up to any required.

Gould & Eberhardt Worm Hob

In connection with its method of automatically hobbing worms, the Gould & Eberhardt Co., Newark, N. J., has recently developed and placed on the market a hob, which is shown in the illustration.



GOULD & EBERHARDT WORM HOB

In this hob the fundamental principle is that of a broach coiled around a cylinder, and it is claimed that the well-known advantages of accuracy and extremely rapid production inherent in the broaching process have been secured. The progressive removal of metal accomplished makes possible the use of heavy cuts and feeds. The hob can be used either to finish the teeth of worms, or for roughing them preparatory to final grinding.

In the case of multiple threaded worms the accuracy of spacing of the teeth is due to the progressive and continuous indexing characteristics of the hobbing method.

This hob can be furnished to cut worms with teeth of any desired contour. The hob teeth, which have somewhat the appearance of a spiral, have their tops cut down in regular steps, and also have their sides recut to different leads. There are about fourteen roughing and three finishing teeth, which can be made either hooked or radial.

Due to the recuts on the tops and sides of the teeth mentioned above, each hob is suitable only for the worm for which it was designed. Other worms would require hobs designed specially therefor.

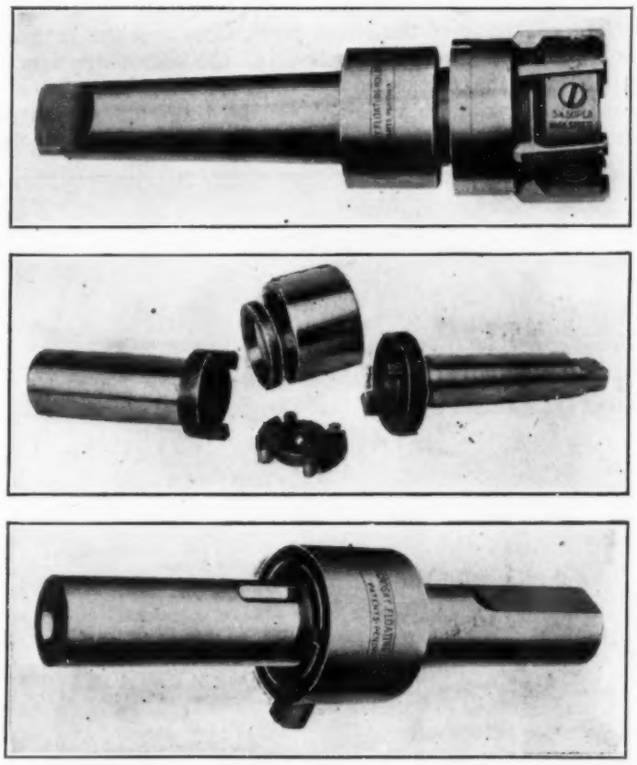
Having a total length of not more than twice the normal circular pitch of the worm, this hob can successfully thread worms having a shoulder on one or both ends, needing very little clearance.

McCrosky Floating Toolholder

The McCrosky Tool Corporation, Meadville, Pa., has recently placed on the market a floating toolholder for the driving of reamers, taps and counter-bores. The holder is intended for correcting for both angular and parallel mis-alignment of the machine spindle with the hole being machined, being adapted to use in drilling machines, boring mills, lathes and automatic screw machines. The device is said to have perfect freedom of action and to be practically free from friction.

The holder is composed of three principal units, a driving member, an intermediate floating member, and a driven member. Two lugs on the driving member interlock with two similar lugs on the driven member, the construction of the parts being shown by the view at the center of the accompanying illustration. Four hardened rollers operate between these lugs and the intermediate floating member, to remove friction between the parts. In the center of the floating member is a hole in which is placed a hardened steel ball. The ball, having a diameter greater than the thickness of the floating member, therefore bears against both the driving and driven members, taking the entire thrust of the cut and acting as a pivot. The housing enclosing the floating unit screws on to the driving member. It has an adjusting collar which bears against the driven member and regulates the amount of float or free motion.

The holder is regularly made in three sizes and both



TYPES AND CONSTRUCTION OF McCROSKY FLOATING HOLDER

the driving and driven members are made in different styles and sizes to suit the requirements of the work. The driving member is ordinarily made in diameters of 1, 1⅜, and 2¼ in. when straight, and in Morse tapers from No. 1 to 6. The driven ends can be made to hold reamers from 1½ to 6 in. in diameter, or bored with either a straight hole from ⅝ to 1⅝ in. in diameter or with a Morse taper from 1 to 5, or to fit a shell reamer. The view at the top of the illustration shows a holder carrying an expansion reamer and intended for vertical use.

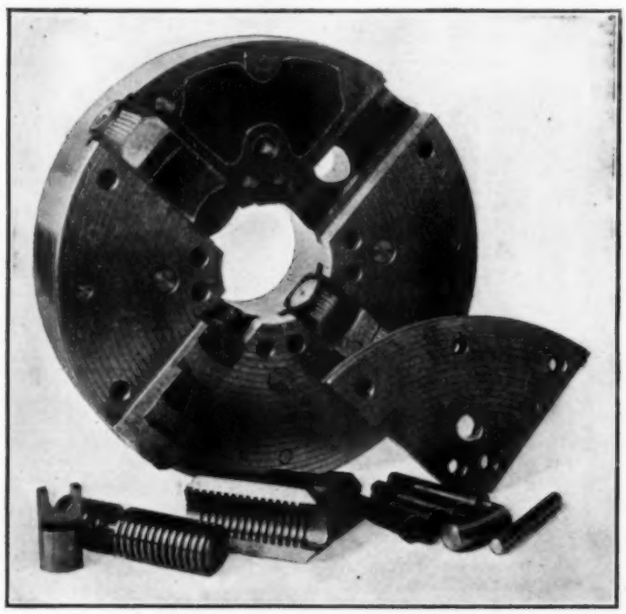
The holder can be used either horizontally or vertically. For horizontal use, an adjustable spring support bearing against the driven member is added so as to counteract the weight of the toolshank and to hold the toolpoint on center. The view at the bottom of the illustration shows a straight-shank holder bored to receive the cutting tool, and with the adjusting screw on the sleeve, so as to fit it for horizontal use.

Coventry Four-Jaw Independent Chuck

Alfred Herbert, Ltd., Coventry, England, and 50 Church St., New York, N. Y., has recently placed on the market a line of lathe chucks having four independently operated jaws. The chuck is similar in principle and construction to the three-jaw chuck made by the concern, the strength and long life of the tool being the features emphasized by the maker.

The body of the device is thick and heavily made, so as to prevent breakage due to excessive pressure at the jaws. The front of the chuck is made in the form of detachable sectors secured to the body by means of screws passing from the front to the back. The accompanying illustration shows one of the plates, as well as a jaw and screw, removed so as to show the construction. The chrome-nickel screws are of large diameter, and the jaws and their operating mechanisms are said to be heavy enough to withstand all working strains.

The diameter of the chuck and recess and the tapped holes for the studs at the back of the chuck are identical with the corresponding size of "Coventry" concentric chuck, with which it can be interchanged. On lathes made by the concern, the chuck is attached directly to the spindle flange by studs and nuts. For spindles that are not flanged, adaptors must be used and must be turned up in position on their own spindles before attaching the chuck.



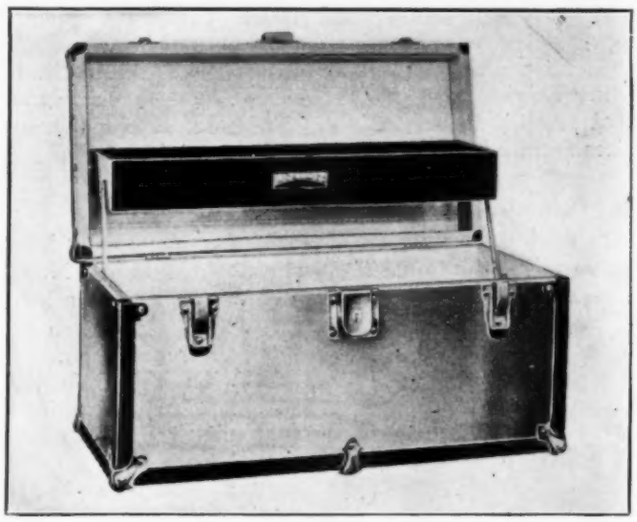
COVENTRY FOUR-JAW INDEPENDENT CHUCK

The chuck can be furnished in a range of sizes, but the maker states that immediate deliveries can be made on those of 15½-in. diameter.

Union Zinc-Covered Tool Chest

The Union Tool Chest Co., Inc., Rochester, N. Y., has recently placed on the market a line of zinc-covered tool chests. The chests are made in a number of styles and intended for the use of machinists, patternmakers, carpenters, electricians, garage mechanics and the like. The illustration shows a general service chest, opening at the top, although side opening chests can also be furnished. The tray automatically raises when the top is lifted, and retains a horizontal position for all positions of the top.

The frame of the chest is made of wood, a lock-corner being used for the joints. The outside is entirely covered with lacquered sheet zinc, which is formed over all of the edges. The chief advantage of the covering is said to be the fact that it will not rust nor corrode. The corners, clamps and other fittings are made of either brass plate or lacquered steel, and riveted in place.



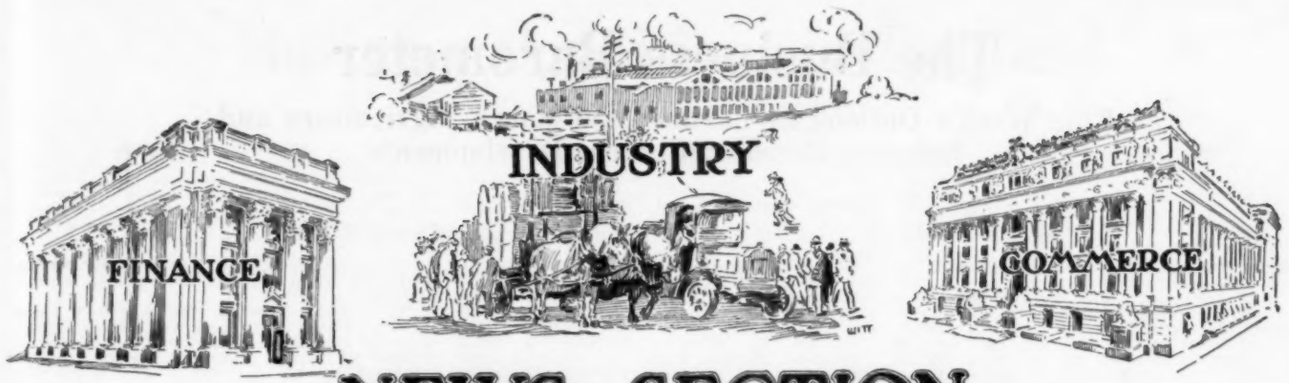
UNION ZINC-LINED TOOL CHEST

The chest can be furnished in various sizes, either with or without trays, ranging in length from 13 to 32 in., and in weight from 5 to 21 lb. The maker claims that the particular advantage is in the strength and durability of the chests, which render them capable of giving hard and continuous service.

Detroit Alloy Steel Center

The Detroit Alloy Steel Co., 1436 Lafayette Blvd., Detroit, Mich., has recently placed on the market a line of centers for lathes and grinding machines. The device is made of a special alloy known as "Diamond H," which is very hard and tough, and also non-magnetic.

The centers are cast and ground, as the metal cannot be machined in any other way. The advantages claimed are long life and freedom from abrasion of the centers in the work.



NEWS SECTION

Pan American Postal Congress Next Week

The Second Pan American Postal Congress will be held at Buenos Aires on August 10. The First Postal Congress was held at Monte Video in 1911. The provisions of the Universal Postal Union, to which all the leading nations belong provide for lesser unions or restricted congresses.

The countries participating in the Pan American Congress are as follows: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Salvador, United States, Uruguay and Venezuela.

In addition to discussing postal details that will contribute to better mail service of mutual concern to all Pan American countries, the Buenos Aires Postal Congress will consider particularly letter mail, post cards, printed matter, samples of merchandise, and commercial papers, which pass between these countries. It is hoped to develop situations which will aid in improving parcel post and money order facilities.

In connection with the parcel post between these countries it is desirable that uniform customs methods may be adopted so as to avoid irritating delays and exactions. At present each country has its own customs regulations which retard parcel post deliveries between all countries.

The United States Government will be represented at this congress by O. K. Davis, secretary of the National Foreign Trade Council, and by Edwin Sands, superintendent of the Division of Foreign Mails.

Fordney Bill and South

A congress of representatives of all southern industries has been called for Greensboro, N. C., August 15 and 16, to discuss the effect of the Fordney tariff bill on the South, and to name a committee to represent the Southern Tariff Association before the Senate Finance Committee when it begins hearings on the tariff. Virtually all lines of southern industry are represented in the membership of the Southern Tariff Association.

Morocco To Purchase Steel Rails in United States

A report from the American consulate general at Tangier, Morocco, says that American firms are invited to submit proposals for furnishing 3,000 metric tons of steel rails and 8,000 pairs of fish plates for construction on the Tangier-Fez Railway. Bids should be addressed to the "Commission Generale Edes Adjudicatio et des Marches," Tangier, and will be opened at a public meeting on Aug. 20.

All bids are to be made in French francs and are to include delivery at the port of Kanatra, delivery to be completed within 80 days after notification of acceptance. The rails required are French standard 36 kilos to the linear meter, 5,200 to be 12 meters in length, 455 to be 11.97 meters, 900 to be 11.94 meters, 160 to be 66 meters, 210 to be 8 meters and 210 to be 10 meters long.

Technical and financial conditions governing this order, together with blueprints bearing the specifications called for have been forwarded to the New York district office of the bureau where they are available for inspection by interested parties.

Better Training for Mechanics

It is proposed to hold a conference in Philadelphia to discuss methods for restoring the apprentice system of training young men in the trades. There is complaint that this system has been greatly restricted by labor organizations and that there is laxity in admitting the untrained to employments for which they are not qualified.

The result has been a deterioration in the quality of output as well as a falling off in the morale of men employed. As a consequence good, well trained mechanics are scarce in proportion to industrial needs, and they are all the time growing scarcer. This is bad for the mechanics and bad for the country. High wages and prospective advancement are the rewards of skill. To the attainment of skill there is no royal road. It is acquired only by conscientious application under equally conscientious instruction.

It is the purpose of those back of the apprentice conference movement to provide ways and means for apprentice training and instruction which shall be thrown open to all, irrespective of any limitations which have been imposed by certain crafts. With more and better mechanics the country's industrial output will be larger and better. On the other hand, ill-directed, circumscribed, haphazard mechanical training of employees, from which our industries have suffered more or less, means a serious national handicap in the sharp world competition ahead.

The matter of improvement in this respect has been taken up by the industrial committee of the Philadelphia Chamber of Commerce. It has interrogated many boards of trade and it has digested a mass of data assembled by experts employed for the purpose. The conclusions reached are that a large proportion of the young men in the various industries merely drift in with wholly inadequate training; that they never acquire skill proportionate to their natural capacities; that, as a consequence, they do not prosper personally as they should and do not produce the wealth the country might expect from them. Some of the experts estimate that 60 per cent of the younger mechanics in this country are thus handicapped.

The responses which have come to the Philadelphia committee have been encouraging. There is distinct promise of valuable results from the proposed conference, and this not merely for Philadelphia but nationwide in inspiring similar efforts in all the great industrial centers.—*New York Herald.*

Alabama Iron

Alabama's June production of iron was the lowest it has been in ten years, according to a report for the month that has just been issued. The total for the month amounted to 93,224 tons. A comparison of the figures for the past three months with those of the same period in 1920, furnishes ample proof that iron production in the Alabama district has reached a remarkably low ebb.

Month	1921	1920
April	94,910 tons	191,389 tons
May	94,013 tons	212,246 tons
June	93,224 tons	209,087 tons

Furnaces active in June of this year were 9 as compared with 26 in the same month a year ago.

Foremen's Conference at University of Tennessee

The first Foremen's Conference ever held in Tennessee, in the interest of industrial education, has just been adjourned at Knoxville. It was held under the direction of the University of Tennessee and was conducted in connection with the summer school work of the university.

The instructions were under the immediate direction of T. H. Quigley, federal agent for industrial education. The work covered a period of one week and about forty hours were required to finish it. Representative foremen and educators from all parts of the state attended and it was the unanimous opinion that the instruction was very beneficial and it is hoped that more work of this character may be conducted in the future.

This is in line with the promotional work that the University of Tennessee has been conducting for a number of years, the previous work being extension courses in science and the trades.

After concluding his work here, Mr. Quigley left for Minneapolis where a general conference on industrial education will be conducted from July 18 to Aug. 18. He will take an active part in the work of means and methods for establishing continuation schools.

Questionnaires on Housing

With the appointment of John M. Gries, of the Harvard School of Business Administration, as the permanent head of the new division of housing created by Secretary of Commerce Hoover, the new Government agency is in a position to address itself immediately to its task of encouraging home-building. A questionnaire has already been sent out by Prof. Gries, from the return of which the most acute phases of the housing problem may be indicated. These replies will determine in large part where the main efforts of the division are to be concentrated.

Automotive Engines Are Built in Argentina

Trade commissioner George S. Brady, at Buenos Aires, reports that there is one factory in Argentina building marine gasoline and oil engines. This factory, which has been in existence for eleven years, is now consolidating its machine shop and foundry and has begun the construction of new buildings to house the plant. At the present time the factory is producing 15 motors per month varying in size from 6 to 60 horsepower. The engines are of two and four cylinders, modeled after English patterns. All parts with the exception of roller drive chains, roller bearings, magnetos, and a few supplies are made in the factory. The company advertises to make a specialty of casting cylinders and apparently turns out an excellent product. It supplies cylinders for the repair of marine, automobile and tractor engines. With the repair work in addition to the regular product, the foundry casts 30 to 50 tons of iron per month. All steel is imported from England. The motors are sold direct to local boat builders, and the present factory capacity is said to be inadequate to supply the demand.

[The name of the factory may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or the district and co-operative offices upon reference to File No. 46363.]

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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Signs multiply that Comptroller Crissinger was right when he predicted a period of gold inflation. The gold inflow continues in undiminished volume and the holdings of the Federal Reserve Banks at the close of business last Thursday showed an increase of $23,000,000 for the week. As a result the reserve ratio gained nearly 1 per cent and now stands at 63.4, the highest point in more than three years.

Call money is down to 3½ per cent and the very best commercial paper can now be sold at less than 6 per cent. Liberty bonds, Treasury certificates and other interest bearing obligations which have a broad market and fluctuate in inverse relation to interest rates are gradually advancing. This is always the first stage of what is called by some "inflation" and by others prosperity. No matter what it may be called it is due to the increase in our gold supply and to the apparent reversal of the deflationary policy by which until recently the Federal Reserve Board and Banks were inspired. As to whether their change of heart is due to the criticism to which they have been subjected by ex-Comptroller Williams, Senator Owen and others, or to a quickened sympathy with farmers and business men, we need not now inquire. Mr. Williams' appearance before the joint committee of the House and Senate has been postponed until Aug. 2, but the Congressional Record of July 25 contains some rather sensational correspondence between Representative Bland of Georgia and Vice Governor Platt of the Federal Reserve Board, from which it would appear that the Federal Reserve policy is rapidly becoming a political issue of the first magnitude.

Meantime it may be taken for granted that there will be plenty of money to move the crops without any financial discomfort or drain upon the investment funds of the country. The volume of new security issues has accordingly increased sharply during the week, an offering of $300,000,000 of Treasury notes, part of which bear the lowest interest rate offered this year, being heavily oversubscribed.

But easier money is helping the commodity as well as the investment markets and those who have hesitated to buy before they sold are now becoming more confident of their ability to distribute merchandise and are therefore willing to replenish their exhausted stocks. As I pointed out last week, in many lines they are finding that they have delayed too long and that earlier underproduction has created something of a shortage.

This is particularly apparent in the textile trade. The latest market letter of the National Wholesale Dry Goods Association comments upon the acute scarcity of at least four lines, one of which is ginghams. This report should be read in connection with others showing unusually heavy retail sales of cotton piece goods, a notable increase in the distribution of dress patterns, especially of the simpler kind, and a remarkable growth in the sale of sewing machines by a Chicago mail order house. The revival of home dressmaking, the astonishing maintenance of chain store sales at a high level and the increase in savings deposits in Greater New York by $110,000,000 during the first six months of 1921 are each in their way evidence of the hard work and economy to which we must look for increased production at lower costs and complete resumption of business on a basis mutually profitable to capital and labor.

Agitation for lower railway rates shows no sign of decreasing, and their reduction may be the next great specific influence to bear on business improvement. Industrial leaders are taking care that the public is not left in the dark as to the important relation freight rates have to prices. For instance, in announcing a recent price cut a prominent steel man showed that the making of a ton of finished steel requires the transport of more than five tons of raw materials, and the increase in the charge for this transportation represents more than a third of the total increase over the pre-war cost. Rumors are already in circulation that the roads will soon ask another reduction in wages, to be followed immediately by a reduction in freight rates, and where there is so much smoke there is likely to be fire.

The condition of the roads is steadily improving. The crop movement is beginning to bring the surplus cars into use, June earning reports showed radical reductions in expenditures and their financial position will be greatly strengthened when President Harding's plan of funding their debts to the government while at the same time paying the government's debts to them is acted upon. Therefore it seems improbable at present that it will be necessary to act on the appeal of 400 Michigan fruit growers that Henry Ford should be put in charge of all the railroads.

Public appreciation of the improved prospects of the railways is shown in the firmness of their shares on the Stock Exchange, but it may still be pointed out that their total securities are selling at little more than $12,000,000,000, while their original cost of construction was around $20,000,000,000 and their reproduction cost at present values would of course be considerably more.

More idle employees are being recalled and put to work on delayed improvements and repairs. The revival of railroad buying, which is not now far distant, will give impetus to many industries, especially the laggards, lumber and steel. I was surprised the other day in talking to a prominent rubber dealer to find that even he was looking forward to railway buying to strengthen the rubber market. He explained that in the aggregate the tonnage of rubber products used by the roads was considerable and that he looked for a definite improvement in business as soon as they began purchasing.

Rubber men are in fact becoming affirmatively optimistic. The steady increase in tire manufacturing and consumption has been beyond their hopes, the demand is increasing, and the crude rubber market is strong. Automobile business is fairly well maintained, though this industry is still suffering somewhat from indigestion and would be better off if it had fewer makes and lower production costs. Steel mill operations seem to be picking up at last, and Judge Gary is distinctly hopeful. The leather export trade has turned the corner to better times and hides are strong and active. Petroleum production during June showed a decrease for the first time since January, a good sign that the reckless exploitation of our resources is being curtailed and the market becoming more stabilized. Even coal men look for better business as the season wears on and the time when buying can be no longer postponed comes nearer. The American Woolen Co.'s opening of spring fabrics, at prices mainly unchanged from last year, was entirely successful, demand in a few lines reaching record proportions.

In the grain markets rash enthusiasts are talking of $2, wheat and higher prices before the end of this crop are widely expected. Sugar is again higher for both raw and refined, the latter having sold at six cents per lb. and the Cuban crisis is in consequence becoming daily less acute as the large stocks held there find buyers despite the predictions of the pessimists.

Cotton futures are somewhat lower on speculative short selling inspired by an alleged improvement in the crop outlook, but the War Finance Corporation is broadening its aid to exporters and in cotton as in sugar it may be that the weight of the statistical surplus has been exaggerated. Certainly there is no prospect that the growing crop of cotton will be in excess of the world's reviving consumption and those who hold the residuum of the present supply will probably continue to hold it for some time.

The tariff bill having been passed on to the Senate seems likely to be sidetracked at least for the present, as President Harding is urging that prior consideration should be given to the much more important matter of tax revision.

The week's statistics indicate that the volume of trade is well maintained. The National Association of Manufacturers predicts that July exports will show an increase over June in several of the more important classes of goods and more foreign buyers are arriving in the United States. Bank clearings for the week as reported by Bradstreets are 22.8 per cent under last year, which indicates a trade fully up to last year when the decline in prices is considered.

The Credit Clearing House shows more buying, less indebtedness and better collections in July than in June and the improved status of affairs generally is thus summarized by the American Exchange National Bank of New York in a circular which says: "More progress toward the realization of plans for the composition of the affairs of the world on a basis of sanity and common sense was made in July than in any month since the armistice was signed. The progress was really stupendous in its significance."

The market for foreign exchange is slightly lower, reflecting so it is claimed, Germany's gradual accumulation of "dollar drafts" against the next big reparation payment to be made Nov. 1. This is, however, conjectural, for as previously stated the speculation in exchange is enormous and no one can gage the significance of the daily fluctuations. It has been reported and denied that the Treasury Department is trying to control or suppress this speculation.

Japan's promise to attend the disarmament conference assures that this momentous gathering will be held and upon the action there taken the future of the world's civilization is momentously dependent. Meantime the sore spots in Europe appear to be rapidly healing. In Turkey, Greece and Silesia there is still some suppuration, but elsewhere the wounds of the war are gradually becoming scars that will, it is to be hoped, serve to remind men of the horrors of war without reviving its enmities.

From Germany the reports are conflicting. Some say that in the travail of war German industry has been born again and will shortly overwhelm the world with cheaply manufactured goods, but as most of the raw material out of which these goods would be made must be imported it is to be doubted the world's fear of German competition is entirely warranted.

British trade is improving and the London Stock Exchange is almost bouyant as a result of the reduction in the Bank rate and the hope of still cheaper money that it has inspired. The same statement is measurably true of France as the Bank rate there has also been reduced to 5½ per cent.

On this side the Atlantic Mexico is still an unsolved problem upon which the news of the week does not shed much light. The statesman who can find a way to reopen Mexico to American capital and enterprise without affronting the hypersensitive egotism of the Mexican people will do a great service to both countries and may initiate the next great boom in American business. The reestablishment of orderly government in Cuba after the Spanish American War was the occasion of a great business revival in the United States and the settlement of the Mexican question might work a similar change in our psychological condition. Such a change would seem to be the one thing necessary to the better feeling that is the inspiration as well as the product of better business in this country.

The War Department no longer holds any motor equipment which can be construed as surplus. As a result the wild scramble on the part of other government departments to secure transfers of this equipment is over. At present the War Department has insufficient motor cars for its own use, it is declared. More than 50,000 motor vehicles were transferred to other government departments. Over 30,000 were transferred to the Bureau of Public Roads for distribution among the states.

Obituary

Just as we go to press, we learn of the death of E. A. Suverkrop formerly a member of the editorial staff of the *American Machinist* and very well known in the machinery industry, both here and abroad. A full obituary notice will appear in our next issue.

Business Conditions in England

BY OUR LONDON CORRESPONDENT

Great Britain, or perhaps to maintain the self esteem of the other portions one should say England, appears to be muddling through her labor troubles. As far as can be gathered these are being settled on no particular plan, except that reductions of wages are being effected. Still they are being settled, if only temporarily, for further drops in wages may be anticipated as time goes on. The coal dispute was ended without any regard to price to be obtained for the product. Yet this is one of the most important considerations for the iron and steel and, in fact, most construction industries. By some ironmasters 20s. a ton has been quoted as the limit of price for coal for bare renewals of working; others have asserted that pre-war prices must prevail if foreign competition is to be met. With the aid of a government subsidy of £10,000,000 the miners are guaranteed certain wages for a period and the coal owners, as they are called by courtesy (for it was long ago discovered that "the earth is the landlord's and the fulness thereof"), are to take as profits 17 per cent of the wages paid with the same proportion of any surplus profits, the remaining 83 per cent going to the miners. Whether there will be any surplus profits remains to be seen, for it is reasonably certain and has been prophesied that wages will be adjusted to avoid them. This is of no great importance, the outstanding fact being that the profit-sharing system has been devised without any regard for the consumer. It is to the interest both of the miner and mine owner that prices shall be forced up to the very limit that can be paid. The demand for a wages pool has been abandoned, and wages will be regulated from district to district. In three months the contest has cost the miners in loss of wages some 50 million pounds and the loss to the nation has been estimated at five times that figure. Nevertheless it is all to the good that workers of this class are busy once more. The cotton and woolen industries have composed their differences, cuts have been accepted by certain electrical and gas workers, and it really looks as though, for the time being, peace will be maintained in the engineering industry. As the result of two months or more of negotiations, certain terms were put before the members of the trade unions concerned —and were very definitely rejected. Nevertheless it is probable, is indeed generally taken for granted, that newer proposals will be accepted implying a reduction of 3s. a week almost at once and a similar reduction in a month's time, leaving the question of the removal of the Ministry of Munitions, or Churchill, 12½ per cent bonus to be decided according to the position of the industry in September. This is rather like merely postponing trouble, and it is probable that in any case workpeople will have to bow to the inevitable. For it is very unlikely that the present wage reduction will be sufficient to stimulate trade, and with the possibility of the further 12½ per cent coming off it looks as though buyers, when they can, will hold off to make sure of the further reduced prices. Consequently the present unsatisfactory state of employment will continue, the funds of the trade unions being further depleted, and the trade unions themselves will be in a worse condition for a fight, should this seem necessary.

By the terms of the agreement with the miners, national and district boards are to be constituted with representatives in equal numbers of coal owners and workpeople. Wages are to be periodically adjusted according to district, based on returns for the previous period, and surplus profits are to be ascertained after account has been taken of the cost of standard wages, plus the cost of production other than wages and standard profits equal to 17 per cent of the standard wages. Special allowances are to be made for districts which do not provide a subsistence wage for lower grade workers, and in all cases the units are the districts according to a schedule. Standard wages will be the district basis rates as at the end of March last, plus the district percentage payable in July, 1914, or equivalent, plus for piece workers the percentage additions made as the result of reduction of hours from 8 to 7; but in no district will the wages be lower than standard wages plus 20 per cent. The government subvention, not to exceed £10,000,000, will be used to prevent falls in wages in July, as compared with March last, greater than 2s. a shift to persons above 16 years of age, or 1s. a shift for younger persons, the reduction during August being 2s. 6d. and 1s. 3d., and during September 3s. and 1s. 6d., provided the subvention is sufficient for the purpose. The agreement runs up to the end of September, 1922, and thereafter until terminated by three months' notice.

Cost of Strike to Government

An estimate has been given in Parliament of the charges on the exchequer as a direct result of the coal troubles. In addition to the coal industry subsidy of £10,000,000 there was the sum of £7,000,000 for the defence force, army reserves, etc., £1,225,000 for the navy, £330,000 for the air force and £300,000 for civil emergency organizations. As to indemnification on railway profits, this will probably cost more than £10,000,000, and there may be further charges due to coal purchase operations. Meanwhile, according to the latest return persons on the unemployment registers of the Board of Trade numbered 2,177,899, with 832,000 persons claiming in connection with short-time working, plus of course the coal miners on strike, and others.

Meanwhile, in view of the financial position the government is to offer a new cash loan in the form of a series of 5½ per cent bonds, maturing in 1929, the issue price being 97. Obligations are maturing one way or another to the extent of £300,000,000, and against this the budget provisions present £100,000,000. But it is of course recognized that the budget estimates will in all probability not be realized. Apart from the slackening of trade and losses due to the coal troubles, the revenue returns are making a rather bad showing. This is perhaps due to a decline in the yield of excess profits duties and in the sale of surplus stores.

Machine Tool Situation

The failure to obtain bids of any amount has led to the indefinite postponement of government auctions of stocks, including much in the way of machine tools. On the other hand, the closing-down of various engineering firms, almost entirely of small magnitude, has meant the public dispersal of a number of plants. In short, despite the generally hopeful feeling no great improvement is shown in engineering as a whole or in the machine tool section in particular. As to the latter, on the continent of Europe, Belgium has been a relatively bright area of late. Trading on the London iron and steel exchange has been reported quiet for, despite labor settlements and prospect of settlements, hesitancy is shown. In the Manchester iron market the general position has been regarded as more uncertain than ever, nothing being known as to the price at which furnace coke will be supplied, and it was freely stated that if fuel prices are not lower than those current when the coal dispute was started there is little prospect of immediate activity. At Middlesbrough the pig iron trade has been quiet and "makers are not inclined to re-start the furnaces on a large scale until fuel is more abundant and raw material generally is cheaper." The finished iron and steel trades are also quiet, but in some works a start will be made almost immediately. As to the coal position, quantities will probably be available in the course of a few days, though obviously full output cannot be reached for some little time; export of coal was expected to commence about a week or ten days after the resumption of work.

Further consideration has naturally been given to economies in the use of coal and attention has been drawn to the fuel research station erected at East Greenwich on the outskirts of London. Sir George Beilby, director of the work, has been considering the—at present uncommercial—production of a solid smokeless fuel intended for domestic use and obtained by the carbonization of selected coals at 550 deg. C., or thereabouts. He mentioned the matter in connection with the 27th James Forrest lecture delivered before the Institution of Civil Engineers. The coke thus produced has no smoke-producing hydrocarbons, but still contains from 10 to 12 per cent of volatile combustible matter which burns with a smokeless flame. The coke is enveloped in these flames and the surface becomes incandescent. In the meantime, economy is being looked for by greater care in sorting at the mine; by improvement in boiler-firing methods; by sorting out combustible constituents by preliminary carbonization and classifying fuels according to heat values, availability and convenience. At East Greenwich the capacity is about 30 tons of coal a day, but about 10 tons a day is being used, and the products are being taken by the neighboring gas company.

Shrinking Profits

The effect of trade conditions on the chief industry of Sheffield may be gathered from the recently issued balance sheet of Edgar Allen & Co., Ltd., steel makers. It relates to the year ending with March last and records a net profit of £42,110 as compared with £83,959 the year previous—a drop of one half. Similarly, the increased cost of production as a whole is illustrated by figures given at the annual meeting of shareholders of Robert Stephenson & Co., Ltd., the Darlington locomotive builders, when it was said that for a given standard locomotive, which in 1914 cost £3,800, the present cost is £11,100. Another case relating to standard locomotives showed that a pre-war cost of £5,000 compared with a present cost of £14,000.

The motor tax, based mainly on horsepower, still meets the opposition of organized automobile owners, though there is no prospect of change this year. In the first five months the tax has provided nearly 8½ million pounds, licenses having apparently been issued for about 853,900 motor vehicles, including motorcycles, while taxed horse vehicles numbered about 261,000.

Hearing on Senator Ladd's Metric Bill

An early hearing on his bill providing for the compulsory adoption of the metric system, after a period of ten years, has been asked by Senator Ladd of North Dakota. Senator LaFollette, chairman of the Committee on Manufactures, states that he is disposed to grant the hearing but that he is dubious of securing the consent of any three members of his committee to act as a sub-committee to conduct the hearings. Senator LaFollette states that there is so much legislation at this time which appeals to him as being of greater importance that he cannot undertake the conduct of the hearing personally. He expresses the opinion that it will be difficult to find three members of the committee willing to take the time for metric system hearings during the consideration of the tariff and other matters of first importance.

Senator Ladd's plan is to conduct a short hearing at the earliest possible time in order that the outstanding arguments may be presented by each side, thus giving the public an opportunity to study the relative merits of these contentions. After the convening of the regular session in December, it is his desire to re-open the hearings and go into the question more fully.

Tech Club in Denmark

According to trade commissioner T. O. Klath, at Copenhagen, Denmark, there has been formed in Copenhagen an association called "The Anglo-Danish Technical Society," with the object of promoting co-operation between Denmark and Great Britain along industrial and commercial lines. Capt. H. Ewald, the newly appointed representative of the Federation of British Industries in Denmark, and vice-president of the Danish Cable Manufacturing Co., has been elected president of the association, and Sir Martin Abrahamson, a well known engineer and commercial man, has been made vice-president. Ewald made the following statement to the Copenhagen press with regard to the plans and purpose of the organization:

The society which has just been formed is to be considered in the nature of a technical club. New members will be admitted only if approved by the original members. We expect to establish intimate relations with English industrial and other associations, so that the knowledge and experience gained in Great Britain concerning various commercial and technical conditions will be made available to our Danish members to be made use of to their advantage. The society will have monthly meetings when addresses will be made on technical subjects, and it is also planned to issue and distribute various publications.

Concessions in Russia

By V. Leitis
Riga, Latvia
Formerly Representative in the U. S. of the United Credit Union of Siberia.

It seems that the Bolsheviki are abandoning their absurb radical ideas and are endeavoring to bring about a return to the despised capitalistic order. The following important changes were recently made: Factory committees were abolished and the management was placed in the hands of the more capable colleges and even in the hands of individual persons; time wages were partly abolished by the return to the piece wages and the length of the labor day changed from 10 to 12 hours; the intellectual class, engineers, chemists, etc., was placed in privileged positions; the requisitioning of food products from farmers was abolished and a special tax, to be paid instead, was introduced; free trade was allowed to enable the farmers to sell their surplus; the return to a more stable monetary system, through the aid of printed money guaranteed with salt, is being tried; and the number of employees in all government institutions has been reduced and results from these remaining have been demanded.

Of course, all these changes are more or less in the embryo because the great mass is demoralized and does not wish to follows its leaders, but if the leaders are recognizing that their old doctrines are wrong then that is a sign of recovery. We do not have much confidence in the good intentions of the Bolshevist leaders but famine and poverty will do their part and persuade them to return to saneness.

The official press we find at times to be quite reasonable, and from its opinion of the much advertised concessions in Russia, it would seem that these concessions are worth considering. Soviet Russia is pressed to make use of her natural resources by offering them to the foreign capitalists and the concessions are her only and last hope. She has no other means of attracting foreign capitalists and must offer a bargain, and a very profitable one.

The world revolution seems to have become less important to the Bolsheviki and they are now openly recognizing that they are unable to exist without friendly relations with the rest of the world, which they realize will be impossible until Russia shall have sound economic conditions, stable Russian money, adequate and capable institutions for trade, transport and industry, and until lawful order shall exist.

The Bolshevist press is trying to show that the improvement is beginning. And it is, but without foreign help Russia cannot recover. The official reports prove that Russian industry has now only 10 per cent of its former capacity, and only 30 per cent of the former agricultural products.

Soviet-Russia has no goods to export, and no gold to pay for foreign goods; she knows that a foreign loan is out of the question and that, inasmuch as the right to private prosperity does not exist, there is no possibility of selling Russian land or houses to foreigners. Should they recognize the right to private property they would overthrow their socialistic doctrines —their communism.

In view of these circumstances concessions to foreigners have been made, and the Bolshevist conscience cleared by the statement that, as they must now deal with foreign capitalists, granting them the concessions, such procedure must be regarded as a temporary means to strengthen the revolution.

It was not difficult to understand that those receiving the concessions will take much and give little, and there was great dissatisfaction in the whole of Russia. But as the concessions are the last hope, the last hold of Russia, the masses grew calm and the Vanderlip syndicate got the first concession.

We do not know the particulars of the Vanderlip agreement but we know that the Bolsheviki will grant the best possible arrangement and facilities because they are pressed to do so in order to obtain foreign help. There is no other form of foreign help possible. Russia, without this help, is unable to use her natural wealth, repair her railroads, feed and clothe her population and renew her industry.

Of course, the concessions will bring big profits to the foreign capitalists. There is no doubt about that. The question is only about the safety. If the foreign governments will back their capitalists, we do not see any risk. The Bolsheviki of today are not so dangerous. They will be pressed to be honest with concessionaires and their property. The concessionaires are needed too much to be treated otherwise.

The labor conditions are different now. The laborer is accustomed to working longer and with greater energy than formerly. He will be glad to have plenty of food, adequate clothing and no commissaires on his back.

If the concessionaires will deal with the local Russian market, they will obtain raw materials which will give better profit than money. We do not think Russia will remain long without stable money. Sooner or later there will be lawful order with stable money and private property. All signs prove it.

What can Russia offer to foreign concessionaires? The Bolshevist press mentions the following:

(1) The forests about the Irtish, Ob and Taz rivers, seventy million desiatins. There are rather good harbors and it would be possible to make railroad connections with Petrograd, Murmansk and Archangel. The food supplies could easily be obtained from West Siberia by river.

(2) Nineteen million desiatins of forest along the North Dvina, Suhovka and Pechora rivers.

(3) The coal districts in Altai and Tomsk. The latest investigations proved there should be about 250 million tons of high-grade coal.

(4) Iron ore about Telsbesk (near Kuzneck) with 1,500,000,000 poods of high-grade ore (at a maximum depth of twenty-five fathoms).

(5) Coal district in Ekibastuesk, which is connected by railroad with Irtish, 35,000,000,000 poods of coal.

(6) Zinc ore on the Irtish (Ridder), about 150 million poods of ore, containing 15 per cent zinc, 1 per cent copper and in addition 7 zolotniks of gold and 59 zolotniks of silver in every 100 poods of ore.

(7) Iron ore in Irbin, Abakansk, on the Yenisei river connected by railroad with the rich coal districts of Kaliagin, Iztilsk and Chernogorsk.

(8) Three million desiatins of rich black agricultural land in the Samara, Ural, Don, Cuban, Stavropol, and other districts.

(9) Naphtha in Baku, Grozny, Maikop, etc.

(10) Coal in the Don district.

The data and figures are from the Bolshevist official press organs and cannot be guaranteed. But the writer spent eleven years in Siberia as a business man and knows that there is more wealth than the Bolsheviki offer. The Ural and Caucasus can offer enormous profits but it will require enterprising and bold men to secure them, inasmuch as this territory has been devastated and is without laws. However, it would seem that the result would justify the risk.

One must not always believe every rumor. We know that damaging rumors are spread regarding Soviet Russia in order to keep other competitors away but in the meantime large profits are being earned by dealing with the Bolsheviki. Every day trains are crossing Latvia to Russia with foreign goods. Someone, who is not afraid, is working.

We here in Latvia have plenty of small troubles with the Bolsheviki, but we are not afraid of them. Our railroads are profiteering by the transit which increases every day. Thousands of our wartime refugees are returning from Soviet-Russia, bringing us the most reliable information. We know the Russian people and the country, and know that the foreign capitalists will earn big profits there.

Thermal Stresses in Steel Car Wheels

The investigation of stresses in cast-iron and rolled steel railroad wheels has now been in progress for some time at the Bureau of Standards. With the aid of the results obtained from tensile tests on material taken from the wheels and thermal expansion data obtained on similar materials, computations have been made of the stresses set up by heating the tread of various steel wheels. It was found that the stresses on the outside of the wheel were in compression near the tread and in tension near the hub, the maximum value being in each case greater than the proportional limit of the material. This distribution is similar to that previously found in the single plate cast-iron wheel. In order to analyze further the stress distribution in the wheels, some of them are being prepared in such a way that stress measurements can be taken on the back and also in a circumferential as well as a radial direction.

Washington Notes

By Paul Wooton
Washington Correspondent

One of the very highest duties imposed in the entire Fordney tariff bill is that on tungsten ore and concentrates, which are made dutiable at 45 cents per pound on the metallic tungsten content. This is admitted by Representative Tilson of Connecticut, the chairman of the sub-committee which drafted the metals schedule. The action of the committee in placing such high rates of duty on all the ferro-alloys and then refusing to give an opportunity for these schedules to be amended before the passage of the bill by the House has caused much criticism. It is fully expected that the Senate will reduce these duties, partcularly the one on tungsten. It is contended that tungsten of the grade produced in the United States can be used only in a limited way, making it absolutely necessary for steel makers to import their supplies regardless of the rate of duty that may be enacted. In addition, many mining engineers are of the opinion that the very limited domestic deposits of tungsten should be safeguarded to meet a possible future emergency when it would be impossible to import this essential alloy.

Under the Payne-Aldrich Act, tungsten-bearing ores of all kinds were dutiable at 10 per cent ad valorem. The equivalent of the specific rates in the Fordney bill may not figure, at the present price of tungsten, as much as 300 per cent, but it is admitted that the rate would approach that equivalent.

The increase in the duty on ferro-manganese also was admitted to be very high. It was pointed out, however, that the United States Steel Corporation, the principal manufacturer of ferro-manganese, as well as other manufacturers, opposed this duty. Mr. Tilson stated that the duty is merely a compensatory duty on the manganese content and was put in the bill at the insistence of the mining interests.

The Fordney tariff bill passed the House on July 21 with comparatively few changes in the bill as reported out by the Committee on Ways and Means. The Ways and Means Committee was overruled, however, on the important petroleum, asphalt and dye duties. After an extended debate characterized by great bitterness, crude petroleum, fuel oil and asphalt were placed on the free list. The Longworth proposal that the United States Tariff Commission administer the importation of dyes under an embargo proposal was lost.

Probabilities point to greater changes by the Senate in this tariff bill than has been the case before. Chairman Fordney has the reputation of being that type of protectionist who believes the sky only should limit the upward revision of the rates. The bill reflects Mr. Fordney's ideas. There is much difference of opinion among Republicans as to the wisdom of enacting schedules as high as are those proposed. In many instances, the ad valorem rates are less than are those provided in the Payne-Aldrich Act in 1909. It is claimed, however, that the substitution of American valuation for foreign valuation will have the effect of increasing very materially these ad valorem rates. If the Senate agrees to the new plan of American valuations, it is anticipated that there will be a material reduction in the ad valorem rates. The Senate also is expected to reduce materially many of the specific rates.

"Management Engineering" Launched

The first issue of *Management Engineering*, a monthly, published by the Ronald Press Co., New York City, appeared last month. It contains sixty-four 9 x 12-in. editorial pages. The object of the magazine, according to an editorial statement, is to serve those who are responsible for the operation of industry.

The Editor is L. P. Alford, vice-president of the American Society of Mechanical Engineers, formerly editor of *Industrial Management* and before that editor for the *American Machinist*.

E. W. Tree, who was until recently on the staff of *Mechanical Engineering*, is associate editor of the new magazine.

A feature is the employment, in connection with the articles, of the indexing system used by the Engineering Societies' Library of New York for cataloging its books. This system provides that the article be classified and indexed and that a reference card or cards be made and filed.

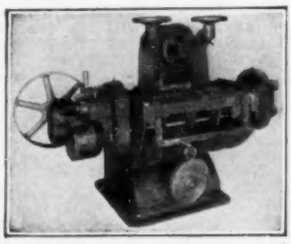
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Milling Machine, Straddle, Model C-70

Newton Machine Tool Works, Inc., Philadelphia, Pa.

"American Machinist," April 28, 1921

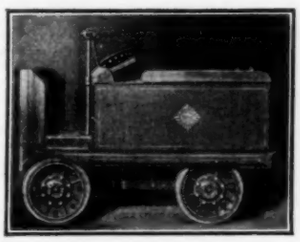


This is a specialized type of machine for facing, with caps removed, the bearings for crankshafts of automotive engines, and at the same time milling the oil slinger grooves. The spindle carrying the cutters does not change position, but the feed motion is obobtained by vertical movement of the table, the loading and unloading being done at the top of the stroke when the table is in line with the conveyor system. The table is raised and lowered by a cam providing slow feed and a quick return. The cutter mandrel is driven from both ends and supported between cutters by bearings, so that it cannot spring or buckle. Spacing collars to give a variation of 0.002 in. are provided to hold the proper dimensions between the cutters. The machine illustrated has eight cutters, to suit the casting being machined.

Tractor, Industrial, Electric, Type-TM

Elwell-Parker Electric Co., Cleveland, Ohio

"American Machinist," April 28, 1921

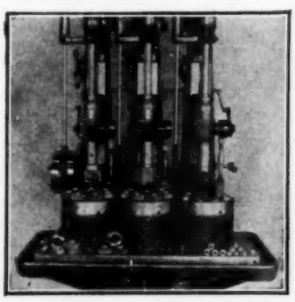


The tractor is designed especially to meet the requirements of iron and steel plants, the motive power being supplied by storage batteries. The drive from the motor is through a worm reduction to a full-floating axle, the power being delivered to 20 x 5-in. drive wheels having 7-in. double-row radial and thrust bearings. The rear of the tractor frame is supported over the drive axle on springs which work in lubricated boxes. The forward, or third point of suspension is on a ball held in a bracket. The frame consists of four heavy channels to which the front and rear bumpers are hot-riveted, the channels being tied together by cross braces and plates. The tractor is steered by a hinged adjustable lever located in front of the operator. It has three speeds in each direction. The normal draw-bar pull is 500 lb.

Nut-Facing Fixture, Automatic

Edlund Machinery Co. Inc., Cortland, N. Y.

"American Machinist," April 28, 1921

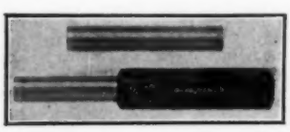


The illustration shows an automatic nut-facing fixture fitted to a three-spindle No. 2B drilling machine. The machine is intended for facing the top surface and bevel on cast-brass hexagon valve-packing nuts ranging from 1 to 2½ in. across the flats. The work has been previously faced on the bottom, tapped and bored. Each fixture consists of a revolving work table, operated and driven by worm gearing. The tool is moved by the arm to quickly approach the cut, is fed to the desired depth, and revolved several times without feed to give a smooth finish to the work. Each work table has seven spaces into which are fitted the work-holding plugs. Chips are removed by a blast. The operator has simply to load and unload the fixtures. All three fixtures can be used for one size of work, or a different size can be handled on each.

Gage, Plug

Van Keuren Co., 361 Cambridge St., Allston, Boston, Mass.

"American Machinist," April 21, 1921

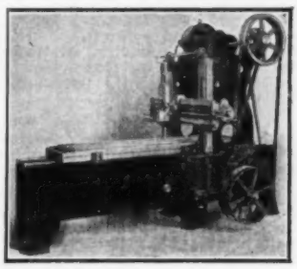


The simplicity of the construction is shown by the illustration. A plain, lapped cylinder constitutes the usable part of the gage. It is inserted for about one-third of its length in a hexagon handle, being cemented in position by means of shellac. The plug is reversible. When one end of it is worn, the handle may be heated in a flame to a temperature about that of boiling water, so that the plug can be removed and its position reversed. The plug is made by a special process of manufacture, which is said to result in a cylindrical surface of fine finish and great accuracy, in regard to both roundness, straightness, and size. Standard sizes of the gage, up to ½ in. in diameter, are made in the type shown. A different type of handle is used for larger sizes.

Planer, Changes in, Wilson

Morley Machinery Corporation, 215 North Water St., Rochester, N. Y.

"American Machinist," April 28, 1921

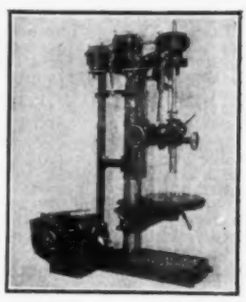


The illustration shows the type of motor drive now fitted to the planers, the motor being mounted on top of the uprights and the usual double-belt arrangement being used. The pad for mounting the motor has been added to all sizes of the machine, even though the drive be from a countershaft, so that the motor drive can be easily fitted when desired. The ends of the bed have been squared and the cross-sections strengthened, while additional support has been placed under the uprights. The width of the bearing surface on the cross-rail has been increased, and all the racks are made of steel instead of cast iron.

Drilling Machine, Upright, Heavy-Duty, 21-In.

Fosdick Machine Tool Co., Cincinnati, Ohio

"American Machinist," April 28, 1921

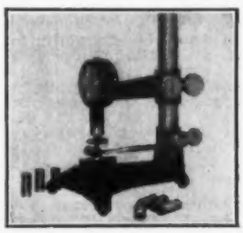


The machine is heavily made, in order to produce accurate work. It is ordinarily driven by a constant-speed belt to tight and loose pulleys on the speed box. A range of spindle speeds from 49 to 550 r.p.m. is thus obtained, being suitable for driving all sizes of drills above ¼ in. in diameter and boring tools up to 5 in. in diameter. There are five geared feeds, ranging from 0.004 to 0.028 in. per revolution of the spindle. The machine is equipped with a tapping attachment controlled by a lever on the spindle head. It may be driven by a constant-speed motor geared or belted to the speed box or by a 3-to-1 variable speed motor. The machine can also be furnished as a gang drilling machine, having from two to six spindles and various types of tables, bases and drives.

Comparator, Dial

B. C. Ames Co., Waltham, Mass.

"American Machinist," April 28, 1921



The device is intended for use in the shop on production, as well as in the inspection department. All parts are protected from dust and all bearing surfaces are hardened and ground. The gage is adapted to use on most work ordinarily checked by micrometers, but the gaging pressure is controlled by a spring. The dial is 1¾ in. in diameter. A movement of 0.0005 in. at the measuring point appears as ¼ in. on the dial. The point has a travel of ¼ in. so that although the gage be set to a 0.500 in. standard, it will measure from 0.500 to 0.750 in. The gage is useful on shafts or bushings having more than one diameter of nearly the same size. A stop is furnished for positioning round work. The device is furnished with two anvils, one ½ x 2 in. and the other 2 x 2 in. and scored. It stands 10½ in. high, weighs 10 lb. and is finished in black japan.

Switch, Regulator, Pressure-Operated

Cutler-Hammer Manufacturing Co., Milwaukee, Wis.

"American Machinist," April 28, 1921

The device is more simple and compact than the other diaphragm-type regulators made by the same concern. Its overall dimensions are 6 x 6½ x 8 in. It is used with motor-driven pumps or compressors controlled by a mainline magnet switch or some other suitable automatic starting device. It has two poles, which construction enables it to be used for connecting small a.c. and d.c. motors directly to the line. The air, water, or other fluid under pressure is conducted into a chamber in the base of the regulator, and the pressure acts against a rubber diaphragm and compresses a spring, the normal compression of which can be changed by means of an adjusting nut to allow of operating the switch at various pressures. The difference between the opening and closing pressure is about 20 lb. The device is made for 60 lb. maximum pressure.

Clip, paste on 3 x 5-in. cards and file as desired

Personals

Walter G. Bunzl, formerly chief engineer of the Richmond Radiator Co., New York City, is now associated with the Pittsburgh Electric Furnace Co., of Pittsburgh, Pa. He is attached to the New York office.

William P. Barstow, for twenty years secretary and general manager of the Smith & Winchester Manufacturing Co., South Windham, Conn., has retired from active duty. He is succeeded by Walter Abbe.

Arthur D. Fiske has been appointed traffic manager of the American Steel and Wire Co., with headquarters in Worcester, Mass.

Charles F. Hildreth has resigned as general manager of the Morgan Grinder Co., of Worcester, Mass. This company was recently acquired by the Greenfield Tap and Die Corporation.

E. D. Lines, formerly general manager of the Dahlstrom Metallic Door Co., Jamestown, N. Y., and for eight years with the Art Metal Company, Jamestown, N. Y., has been made general manager of the Central Metal Products Co., Canton, Ohio.

W. H. Heywood, who has been vice-president and treasurer of the Youngstown Boiler and Tank Co., Youngstown, Ohio, for the past two years, has resigned.

Donald P. Hess has become general manager of the Columbus (Ohio) plant of the Timken Roller Bearing Co., succeeding C. N. Replogle, who resigned. Mr. Hess has been connected with the Timken Roller Bearing Co. at its main plant in Canton for nearly three years.

Holden A. Evans, president of the Baltimore Dry Docks and Shipbuilding Co., Baltimore, Md., has resigned from that position and has been succeeded by Clement C. Smith, of Milwaukee. Mr. Smith is also chairman of the board of directors. Mr. Evans will continue to serve on the board.

W. S. Finlay, Jr., has been elected chairman of the Metropolitan Section of the A. S. M. E. The executive committee comprises G. I. Rhodes, R. B. Wolf and A. E. Allen.

Alexander McInnes, formerly sales manager of the Hammond Steel Co., of Syracuse, N. Y., is now occupying a similar position with the Rochester (N. Y.) Forge Co., specializing in a full line of tool steel and forgings. The Iroquois Steel Co., of Buffalo, N. Y., will act as selling agents for Buffalo, Detroit and Cleveland territory.

George H. Kennedy, formerly a machinist at the plant of the William Todd Co., Youngstown, Ohio, sailed Aug. 3 from San Francisco for Honolulu. He has accepted a position there as instructor of machine shop practice in the Kamehameha school, an institution for boys and girls. A new building for use in the work of his department is to be erected and Kennedy is to supervise its construction.

Obituary

Charles C. Butterworth of Philadelphia, Pa., died on July 21 of heart disease. He was 74 years old. Mr. Butterworth was a manufacturer of machinery, being a member of the firm of H. W. Butterworth & Son, Philadelphia.

Major Louis A. Fischer, chief of the Division of Weights and Measures of the Bureau of Standards, died at his home in Washington on July 25, aged 57 years. Major Fischer has been in charge of that division of the bureau's work since its foundation in 1910. Prior to that time he served for many years in the old Weights and Measures office of the Coast and Geodetic Survey. Major Fischer obtained his rank during the war, when he was commissioned to carry forward important work for the Ordnance Department. He was in immediate charge of the section of gage design.

Thomas H. Rabe, age 92, founder of the Canton Malleable Iron Co., Canton, Ohio, died on July 22, following a brief illness. He was born in Washington, Ohio, December 18, 1829. He spent 60 years in Pittsburgh, where he became an intimate friend of Andrew Carnegie. He came to Canton in 1892 and established the Canton Malleable Iron Co., and since that time has resided there.

Business Items

The Riverside Foundry Co. has been incorporated at Silver Lake, Wis. The owners are Charles B. Boher and R. C. Dixon.

Sommers & Co., Milwaukee, Wis., will build a new foundry and machine shop at 31st and Burleigh Sts.

The Co-operation Axe and Tool Co., of Chicago, Ill., has established a plant at Green Bay, Wis., where electroplating and steel refining machinery will be installed.

The Great Western Lathe and Tool Co., has been organized at Cincinnati, Ohio, with a capital stock of $25,000. Henry Albert and J. R. Roginger are named as directors.

The Giant Drill Extracting Machine Co., has been organized at Jersey City, N. J., to deal in machinery.

The Cleveland office of the Illinois Machinery Co., of Chicago, Ill., has been moved to the Kirby Building. Ralph T. Stone is manager at this branch.

The Sullivan Machinery Co., of Chicago, Ill., has opened a supply depot and service station at Terre Haute, Ind. This station will handle orders from the coal mining industries. M. C. Mitchell is in charge.

The Detroit Alloy Steel Co., 1436 Lafayette Blvd., Detroit Mich., announces that it has perfected a process of reclaiming scraps of Stellite so as to make it again available for further use.

Peter A. Frasse & Co., Inc., of New York City, has been appointed sole agent in the metropolitan districts for the Sibley drilling machines, a product of the Sibley Machine Co., South Bend, Ind.

H. D. Warner Co., of Hartford, Conn., has moved to larger quarters at 26 High St. This new building will afford more room for the display of used machine tools, etc.

The Owen Thomas Engine Co., has been incorporated at Cleveland, Ohio, with a capital stock of $25,000. S. W. Phyppars and Murray Smith are the directors.

According to a recent announcement by president B. H. Sinks, the Steelcraft Corporation of America, Cleveland, Ohio, has purchased a substantial stock interest in Howell, Field & Goddard, Inc., of Long Island City.

In order to facilitate the repair of its motor equipment and machinery the Great Northern Paper Co., of Bangor, Maine, is constructing a machine shop at Greenville Junction.

The National Machine Tool and Equipment Co., has been organized at New Haven, Conn., by A. Bletchman, F. M. Schang, Jr., and L. T. Green.

The Link-Belt Co., Philadelphia, Pa., has acquired all of the capital stock of the H. W. Caldwell & Son Co., and Frank C. Caldwell has been elected a director of the Link-Belt Co. There will be no change in the product of the Caldwell plant.

The Stark Sheet Metal Works, Canton, Ohio, has been incorporated by H. B. Manges, E. L. Harrington, A. J. Bartunek, F. M. Wheeldin and J. A. Friend.

The H. W. Steel Shank & Specialty Co., Preston, Ontario, Canada, has been organized and incorporated to manufacture iron and steel products.

The Machinery Company of America, Big Rapids, Mich., announces a reduction in the prices of most of its machinery products.

The Kach Manufacturing Co., has been incorporated at Portland, Ore., to manufacture manifolds, goniometric levels, tools and other machinery products.

The Ray-Shield Manufacturing Co. has been organized at Wilmington, Del., to make automobile bodies and parts. T. F. Hogan, H. E. Algard and I. W. Hogan are directors.

The Kennedy Valve Manufacturing Co., Elmira, N. Y., has purchased the plant of the Ellis Smith Manufacturing Co., in that city. The shops will be used for the production of malleable castings.

Menary & Wetherill, Wetaskiwin, Alberta, Canada, has purchased the Wetaskiwin Welding Works and opened a machine shop there. The company is desirous of receiving catalogs on lathes and other machinery.

The George F. Croak Foundry Co., of Boston, Mass., has been organized and incorporated with a capital stock of $25,000 to engage in general foundry business. George F. Croak, of Athol, Mass., is president and treasurer; Gerald M. Croak and Winthrop I. Nottage are associated with him.

The H. P. Townsend Manufacturing Co., 10 Hoadley Place, Hartford, Conn., manufacturer of machinery for small screws and hardware, recently completed an addition to the plant which will provide additional floor space of about five thousand square feet. The addition is a one-story brick and mill building.

The American Steel and Wire Co., Worcester, Mass., has discontinued its New England sales district office, and the work, with the exception of Worcester and Boston sales, will be handled through New York.

Goddard & Goddard Co., manufacturer of milling cutters, of Detroit, Mich., has opened Eastern sales offices and exhibition rooms at the Manufacturers' Exhibit, 45 West 18th St., New York. James W. Sederquist is in charge of this district.

The machine and annealing shops of the J. D. Crosby Co., Pawtucket, R. I., fabricator of steel, were recently destroyed by fire with a loss of $60,000. They will be rebuilt.

The Logan Husker Co., Bellefontaine, Ohio, has been organized and recently purchased the Mahlon Hostettler plant, formerly the Ironwood Manufacturing Company, at Bellefontaine. The new company will manufacture huskers and feed cutters. Clinton Bowen is president of the company. J. S. Kauffman is vice-president, R. E. Black, secretary, and George Bowen, treasurer.

Completion of the new plant of the Lima Sheet Metal Products Co. is expected by September 1, according to Charles Ackerman, president. The plant costing approximately $110,000 will be 60 x 234 ft. with three wings, each 40 x 60 ft.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A commercial agent in the United States who is about to leave for the Far East desires to secure the representation of firms for the sale of tools, automobiles, trucks, machinery, engines and hardware. Reference No. 35134.

A commission merchant from Japan who is in the United States desires to purchase an ice plant, ammonia compressor, ice-plant motor, vacuum cleaners, cement scales, milling machines, railway supplies and equipment, and second-hand automobiles. Reference No. 35189.

A mercantile firm in Mexico desires to purchase a steam-power caterpillar tractor. Quotations f.o.b. factory, catalogs, and descriptive literature should be forwarded. Cash to be paid. Reference No. 35190.

Forthcoming Meetings

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26. C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

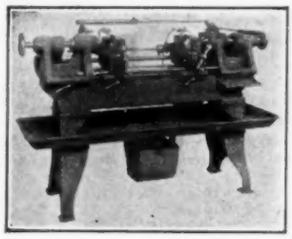
A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The National Machine Tool Builders' Association will hold its Fall Meeting at the Hotel Astor, New York City, October 18, 19 and 20.

Condensed-Clipping Index of Equipment

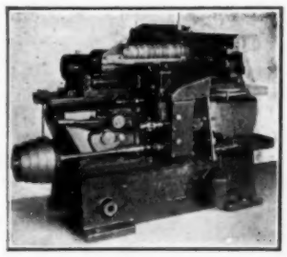
Patented Aug. 20, 1918

Centering Machine, Double-Head
Hendey Machine Co., Torrington, Conn.
"American Machinist," May 5, 1921



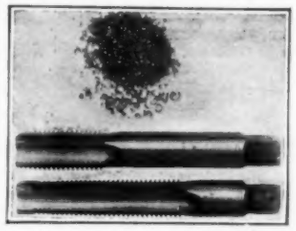
The machine is intended chiefly for centering simultaneously both ends of the bars. Instead of the usual belts driving to the spindles from an overhead drum, a single belt drives a countershaft running on ball bearings and supported on brackets on the rear of the bed. From the countershaft the power is transmitted to the spindles by means of silent chains. The spindles are fitted with spring collets to hold the centering tools. The work-holding jaws are operated in unison through the medium of bevel gears on a splined shaft. A ½-hp. motor is said to be sufficient to operate the machine.

Grinding Machine, Piston-Ring, Automatic
Badger Tool Co., Beloit, Wis.
"American Machinist," May 5, 1921



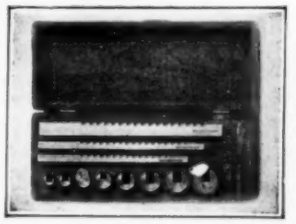
The machine consists of the company's No. 220 grinding machine fitted with special attachments for handling the rings. The function of the machine is to rough-grind the parallel sides of the individually cast rings, bringing them down to approximate size preparatory to the finish grinding operation on a high-precision grinding machine. It is stated that the machine can grind an average of 8,000 rings per 10-hr. day, and that one man can operate two machines. The ring castings are made to pass across the entire grinding faces of the opposed cupped wheels, which are 18-in. in diameter and have 5 in. center holes. The machine is adjustable to take rings varying in diameter from 2¾ to 4½ in., and in thickness from ⅛ to ½ in. The complete equipment weighs 4,500 lb., and 10 to 15 hp. are required.

Taps, Ground, "Easy-Cut"
John Bath & Co., Inc., 8 Grafton St., Worcester, Mass.
"American Machinist," May 5, 1921



The roughing tap is provided with a pilot to square it and keep it concentric with the hole. The first few teeth are similar to the U. S. form but are gradually blended into the Acme form. Alternates sides of the teeth are relieved so that only one side of each tooth does any cutting. The tap being tapered, the cutting is distributed over the full length. The finishing tap, besides having the teeth relieved alternately on the sides, is ground after being hardened to correct any distortion of the lead and helix angle due to the hardening process. The taps are available in U. S. Standard and National coarse and S. A. E., or National fine thread sizes; also in Lowenhertz or International Metric sizes and in special diameters and pitches.

Broaching Set, Keyway, "Handy"
J. N. Lapointe Co., New London, Conn.
"American Machinist," May 5, 1921



The set is intended for jobbers and manufacturers who have a comparatively small number of parts in which keyways are to be cut. It consists of three broaches to cut ⅛, 3/16 and ¼ in. keyways, respectively, and eight bushings for holes ranging in size from ⅜ up to 1½ in. in diameter. Liners are furnished for each broach, so that two passes of the broach may be used to cut a keyway. With the set twelve combinations may be obtained, and keyways cut in holes up to 2 in. long. The broaches are of standard high-carbon steel, and they, as well as the bushings, are ground all over after hardening. The set is packed in a wooden box.

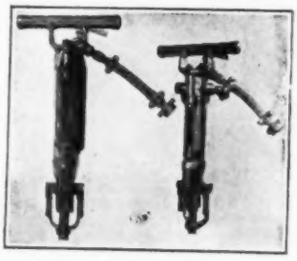
Lathe, Geared-Head, Motor-Driven, 14-Inch, "Economy"
Rockford Lathe and Drill Co., Rockford, Ill.
"American Machinist," May 5, 1921

The illustration shows only the headstock end of the machine, the lathe itself being similar, except for the drive and the head, to that described on page 771, Vol. 51, of the "American Machinist." The headstock is driven by a single pulley and provides twelve spindle speeds in geometrical progression with the use of but thirteen gears. The quick-change gear box provides thirty-two changes of threads and feeds, obtained through sliding steel gears and hardened steel clutches. The motor may be of 1½ or 2 hp. with a constant speed of not more than 1,200 r.p.m. It is mounted on a detachable plate fastened to a base cast integral with the cabinet leg, and driving through a belt kept at the proper tension by means of an adjustable idler pulley.

Welding Machine, Butt, Drill, Type B6
Winfield Electric Welding Machine Co., Warren, Ohio.
"American Machinist," May 5, 1921

The machine is self-contained, and is intended for flash welding high-speed steel drills, handling stock from ¼ to ¾ in. in diameter. A 15-kw. transformer and a 6-step self-contained regulator are provided. The lower dies are copper and the upper dies tool steel. Water circulates through all copper terminals. The work is clamped by hand in dies located at the front of the machine and a single toggle hand lever is used for upsetting the weld. The machine is said to be so constructed that the small particles formed by the flash are prevented from getting into the movable parts and bearings. The floor space is 42 x 40 in., the height of the dies 36½ in., the height over-all 56 in., and the weight approximately 1,000 pounds.

Paving Breaker, Pneumatic
Ingersoll-Rand Co., 11 Broadway, New York, N. Y.
"American Machinist," May 5, 1921



The device is made in two types, BC-25 and CC-25, both shown in the illustration, the former type being intended for operation with higher air pressure than the latter. The device in intended primarily for the breaking up of asphalt and concrete pavement, but is adaptable to a wide range of work. Most of the parts are drop forgings. The handle is of T-shape and the throttle valve is controlled by means of a trigger. The joints are bolted instead of screwed, the working parts being easily accessible. The spring connections provide for the absorption of undue shock. The steel or cutting point is secured to the device by means of holders. The BC-25 breaker employs a "butterfly" valve, the action being very rapid; and the CC-25 machine uses a differential piston.

Shaper, Changes in
Rhodes Manufacturing Co., Hartford, Conn.
"American Machinist," May 5, 1921

A swivelling knee has recently been added to the shaper. Also, the shaper has been made an independent unit by mounting a ½-hp. motor, with a starting box so located as to be within easy reach of the operating position. A countershaft is interposed between the motor and the machine, being driven by a Whitney chain from the motor and, in turn, driving the shaper through a 1¾-in. leather belt running on three-step cones. The knee is finished accurately square in all directions at one setting. The specifications for the machine are the same as heretofore, except that a slightly larger floor space is required for the motor-driven machine. The stroke is 7½ in.; the traverse movement of the saddle, 9 in.; the vertical movement of the table, 7 in.; and the weight 650 lb.

Clip, paste on 3 x 5-in. cards and file as desired

THE WEEKLY PRICE GUIDE

This Week's Market

Steel shapes, sheets, etc., are 15c. cheaper in the New York market than last week, with even lower prices rumored. Sheets are down ¼c. per lb. in Cleveland.

Only changes in the metal market is a ¾c. drop in zinc, and a further decline of ¼c. in antimony.

White and red lead have been decreased ¾c. per lb., which is the first price adjustment since January. The present price of red lead is the same as obtained in February, 1919; that is, 13c. per lb., in 100-lb. kegs.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.80
Northern Basic	25.50
Southern Ohio No. 2	25.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	32.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	27.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	24.40
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	24.96
Basic	23.46
Bessemer	24.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$2.88	$2.89	$3.03
Soft steel bars	2.78	2.79	2.93
Soft steel bar shapes	2.78	3.48	2.93
Soft steel bands	3.43		
Tank plates	2.88	2.89	3.03

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh (refined)	$2.50
Warehouse, New York, delivered	2.78
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	3.53	3.25	3.68
No. 12	3.15	3.58	3.30	4.18
No. 14	3.20	3.63	3.35	3.78
No. 16	3.30	3.73	3.45	3.88
Black				
Nos. 17 and 21	3.75	4.05	3.80	4.70
Nos. 22 and 24	3.85	4.10	3.85	4.75
No. 25 and 26	3.90	4.15	3.90	4.80
No. 28	4.00	4.25	4.00	4.90
Galvanized				
No. 10 and 11	4.00	4.25	4.00	5.70
No. 12 to 14	4.10	4.35	4.10	5.80
Nos. 17 and 21	4.40	4.65	4.40	6.10
Nos. 22 and 24	4.55	4.80	4.55	5.75
No. 26	4.70	4.95	4.70	5.80
No. 28	5.00	5.25	5.00	5.90

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.43	$4.63	$4.00
Flats, squares and hexagons, per 100 lb.	4.93	4.63	4.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 5/32, 8½c. per lb.; ¼, 7.15; 5/16 to ½, 6.75. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.00	6.50	8.25
Spring steel (light)	8.00	6.50	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	3.88	3.44	3.83
Cold rolled strip steel	7.50	8.25	7.90
Floor plates	4.85	3.09	5.78
Special best cast steel	....	15.00	....

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

BUTT WELD

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	64½	52	⅛ to 1¼	39½	24½

LAP WELD

2	56½	44	2	34½	20½
2½ to 6	60½	48	2½ to 4	37½	24½
7 to 12	57½	44	4½ to 6	37½	24½
13 and 14	45	37	7 to 12	35½	22½
15	42½	32			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1¼	62½	51	1 to 1¼	39½	25½
2 to 3	63½	52			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	54½	43	2	35½	22½
2½ to 4	58½	47	2½ to 4	38½	26½
4½ to 6	57½	46	4½ to 6	37½	25½
7 to 8	53½	40	7 to 8	30½	18½
9 to 12	48½	35	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13@13½
Tin in 5-ton lots	26.75
Lead	4.75
Zinc	5.00
ST. LOUIS	
Lead	4.35
Zinc	4.60

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.50	21.50	23.50
Copper wire (carload lots)	15.50	16.50	19.50
Brass sheets	15.75	18.00	10.75
Brass pipe	16.50	22.00	23.50
Solder (half and half) (case lots)	20.00	23.50	16.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	13.75
Cleveland	16.00
Chicago	18.00

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and shot	41
Electrolytic	44

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	11.50	12.00
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	5.25
Chicago	6.00
Cleveland	6.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.50	$10.00
Copper, heavy, and wire	9.00	9.00	8.25
Copper, light, and bottoms	7.50	7.00	7.00
Lead, heavy	3.25	3.50	3.00
Lead, tea	2.00	2.50	2.00
Brass, heavy	5.00	5.00	7.25
Brass, light	4.50	4.00	4.25
No. 1 yellow brass turnings	5.00	4.00	4.50
Zinc	3.00	2.50	2.75

ALUMINUM—The following prices f. o. b. shipping point in cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	25.00	25.00@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	19.50
Chicago	23.00
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	38.50	35.00
Commercial	30.00	13.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	2.00	$2.25	3.00
Hot pressed hexagon	2.00	2.25	3.00
Cold punched hexagon	1.50	2.25	3.00
Cold punched square	1.50	2.25	3.00

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	75%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50%	60–10%	50–5%
1¼ and 1½ in. by 3 in. up to 12 in	40%	50–5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $3.00 Cleveland..... $4.50 Chicago..... $4.00

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.25 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	50%	60%	55%
Larger and longer up to 1 in. by 30 in.	45%	50–10%	50–5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40–10%	10%
Chicago	net	net
New York	50–10%	25–10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50–10%	60–10%	45%
Tinned	50–10%	60–10%	30%

Structural, ½, ¾, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.40 Cleveland...$3.90 Chicago....$4.88 Pittsburgh..$2.65

Boiler, same sizes:
New York...$4.50 Cleveland...$4.00 Chicago....$4.98 Pittsburgh..$2.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	19.00	24.00	25.50
Brass	16.50	22.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ½-2 in., inclusive in rounds, and ½-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$6.85 per 100 lb.; New York prices is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	7.50@10.00	12.00	14.25
Colored mixed	5.50@ 9.00	9.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.00
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$2.75@$3.00
Prompt foundry	4.00@ 4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.80	$0.83	$0.87
5-gal. cans	.83*	.98	1.12

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	12.25	13.75	12.25
25 and 50-lb. kegs	12.50	14.00	12.50
12½-lb. keg	12.75	14.25	12.75
5-lb. cans	15.25	16.75	15.25
1-lb. cans	17.25	18.75	17.25

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

N. Y., Buffalo—Auto Repair Shop, 253 Krettner St., G. F. Wessel, Purch. Agt.—equipment for repair shop.

N. Y., Buffalo—F. N. Burt Co., 540 Seneca St.—one 12 in. and one 14 in. lathe, Universal tool grinder, sensitive drill with 1 in. spindle.

N. Y., New York—B. Mago, 265 West 87th St.—drill press, back geared, power fed, automatic stop.

N. Y., New York—Turner Constr. Co., 37 Hewes St., (builders) A. Brady, Purch. Agt.—metal band saw machine, belt driven, etc.

N. Y., Port Jefferson—E. C. Barker, Jones St., one 11 in. 5 ft lathe with quick change gear, etc.

Pa., Chambersburg—Chambersburg Eng. Co., Lincoln St.—multiple drill head.

Pa., Philadelphia—M. Smith, 845 Brooklyn St., (auto machinist)—one 10 in. screw cutting lathe.

Ala., Birmingham—C. T. Lehman, 2300 Ave. A., C. C. Penny, Purch. Agt.—grinders, hack-saws, also engine lathe, 17 to 20 in. swing, 27 to 30 ft. bed, with paper attachment, 2 face plates, must take 22 ft. between centers, etc.

Va., Richmond—G. M. Greggory & Bro., 611 West Main St., one 36 in. sheet iron metal roller.

Va., Richmond—Ross & Carle Co., 1606 West Main St. (machinists), drill press.

Va., Richmond—C. R. Rowsey & Co., 703 West Main St.—one medium size lathe (new or used) and one drill press for auto repair work.

Ill., Chicago—E. M. Heller Co., 144 West Kinzie St.—two 10 x 72, three 10 x 50 and ten 10 x 36 Norton cylindrical grinders, four No. 12 Barber-Coleman gear hobbing machines, 2 ¾ in. five spindle Detroit horizontal drilling machines (used).

Ill., Rockford—The Bd. Educ., c/o E. E. Lewis, Supt.—manual training equipment for proposed high school.

Ill., Tuscola — The Bd. Educ., c/o G. Fuller—manual training equipment for proposed high school.

Mich., Bay City — Garber Machine Co. Inc.—machine shop equipment.

Mich., Detroit—The Fulton Iron Wks., 3508 St. Aubin Ave., P. B. Selter, Prop.—one multiple blow riveting machine, capable of riveting ⅝ in. cold rivets (used).

Mich., Iron Mountain—E. G. Kingsford—auto repair machinery for garage.

O., Columbus—J. W. Brazier, 37½ South Scioto St.—metal working machinery for new factory on west end of Buttles Ave.

Wis., Milwaukee—L. C. Pauly, Jr., 2530 North Ave.—drill press and lathe suitable for garage work.

Wis., Racine—C. Stuhr 1207 10th St.—14 in. lathe.

Wis., Rice Lake—Burnett Perfect Heating System—sheet metal working machinery, drill press, etc.

Mo., Clarence—A. Burnett, c/o Clarence Auto Co.—drill press, lathe and emery wheel for auto repair shop.

Okla., Miami — F. Stalton—lathe and drill press for garage.

Okla., Oklahoma City—N. S. Sherman Machine & Iron Wks., Inc., 18-36 East Main St., W. S. Sherman, pres.—machine for grinding and one for grooving flour mill rolls (new or used).

Que., Montreal—D. Donkner, 14 St. Lawrence St.—small lathe suitable for garage repair shop and assorted tools for new garage at 319 St. Dominique St.

N. Y., New York—J. S. Kohlmeier, 711 3rd Ave.—power driven hack saw, etc.

Fla., Chipley—Chipley Leather Mfg. Co., F. Tuttle, Genl. Mgr.—machinery for tannery and for the manufacture of leather novelties.

Ga., Waycross—Waycross Packing Co., W. H. Baxley, Pres. and Genl. Mgr.—one 40 x 72 closed retorts, 10 ft. Vance baker steam boxes, conveyors, pulleys, shafting, etc.

Tenn., Knoxville—J. G. Ducan Co., Jackson and Central Sts., J. Ducan, Purch. Agt.—one 20 to 24 in. circular saw, used in good condition, one 24 in. planer, matcher and molder, and other woodworking machinery.

W. Va., Morgantown—Riverside Lumber Co., 616 Monongahela Bldg., D. O. Mallorie, Genl. Mgr.—complete woodworking machinery.

O., Cleveland—Glauber Brass Co., 4917 Superior Ave.—machinery and equipment for new brass goods manufacturing plant.

Wis., Green Bay—The Investment Corp., c/o L. M. Hansen Co., 113 West Walnut St.—refrigerating machinery for cold storage plant.

Wis., Kodan (R. D. Algoma), H. Maedke—special machinery for cheese making.

Wis., Milwaukee—Back Printing Co., 403 Grand Ave.—Paper cutting machine 23 or 25 in.

Wis., Milwaukee—Sullivan Delivery Co., 90 Mason St., A. Lutz, Purch. Agt.—complete electric welding outfit for repair dept.

Wis., Wausau—Marathon Rubber Products Co., B. Rees, Mgr.—additional special rubber working machinery.

Kan., Galena — C. W. Squires — rock crushing machinery.

Kan., Pittsburg—The Pittsburg Marble Wks., Bway., H. and P. White, Mgrs.—electric marble scraper.

Tex., Dallas—Texas Boiler Wks. Co., 3215 Hickory St.—fuel welding machine.

Ont., Chatham — The Rennie Seed Co., Richmond St.—complete machinery and equipment for seed elevator.

Ont., London—The London District Milk Producers, J. C. Nichol, R. R. 2, Wilton Grove, Pres.—equipment for making cheese and ice cream; also for pasteurization and cold storage plant.

Ont., St. Marys—St. Marys Milling Co., H. L. Rice, mgr.—milling equipment.

Ont., Trout Mills — G. Hughes — shingle saws, lathe saws, etc., for shingle mill.

Que., St. Tite des Capes—E. Gauthier—complete equipment for modern bakery.

Metal Working Shops

NEW ENGLAND STATES

Conn., Bridgeport — Estate of S. H. Wheeler, 1188 Main St., plans to build a 1 or 2 story, 80 x 100 ft. garage and repair shop on Middle and Gold Sts. C. F. Baron, 79 Sage St., Archt.

Me., Greenville — The Great Northern Paper Co., Millinocket, has awarded the contract for the construction of a 1 story, 102 x 218 ft. repair shop, here. Estimated cost, $100,000. Noted July 28.

Me., Portland—S. J. Shatz, Bracket St., has awarded the contract for the construction of a 2 story, 50 x 126 ft. garage. Estimated cost, $60,000.

Mass., Hyde Park (Boston P. O.)—Tileston & Hollingsworth, 49 Federal St., Boston, manufacturers of paper, have awarded the contract for an addition on River St., to include a finishing room and machine room. Estimated cost, $40,000.

MIDDLE ATLANTIC STATES

Pa., Warren—The Allegheny Fdry. Co. has been reorganized under the name of Conewango Car Co. and has awarded the contract for the construction of several buildings to replace those which were destroyed by fire, including a 40 x 40 ft. machine shop, a 50 x 140 ft. car building and a 22 x 40 ft. sand building.

MIDDLE WEST STATES

Ind., Laporte — The Advance Rumely Thresher Co., Capitol Ave and Georgia St., plans to build a 1 story factory for the manufacture of farm implements. Estimated cost, $50,000. J. C. Lewellyn, 38 South Dearborn St., Chicago, Archt.

Ind., Michigan City—The Triangle Steel Co., c/o T. C. Casse, 163 Washington St., Chicago, Ill., plans to build a 1 story, 250 x 500 ft. steel factory. Estimated cost, $75,000. Private plans.

Mich., Crystal Falls—The Bd. of Supervisors of Iron County will receive bids until Aug. 13 for the construction of a 60 x 180 ft. machine shop and garage.

Wis., Milwaukee—Filer & Stowell Co., 219 Becher St., manufacturer of saw mill machinery and automobiles, has awarded the contract for remodeling its 1 story foundry. Estimated cost, $25,000.

WEST OF THE MISSISSIPPI

Mo., Clarence—A. Burnett, c/o Clarence Auto Co., plans to build a 1 story auto repair shop. Estimated cost, $45,000. Architect not selected.

Okla., Miami—F. Stalton plans to build a 2 story garage on Main St. Estimated cost, $50,000.

CANADA

Ont., Chatham — The Lorne Tractors Ltd., is having plans prepared and receives bids about Aug. 15 for the construction of a factory. Estimated cost, $150,000. W. A. Greene, c/o owner, Engr.